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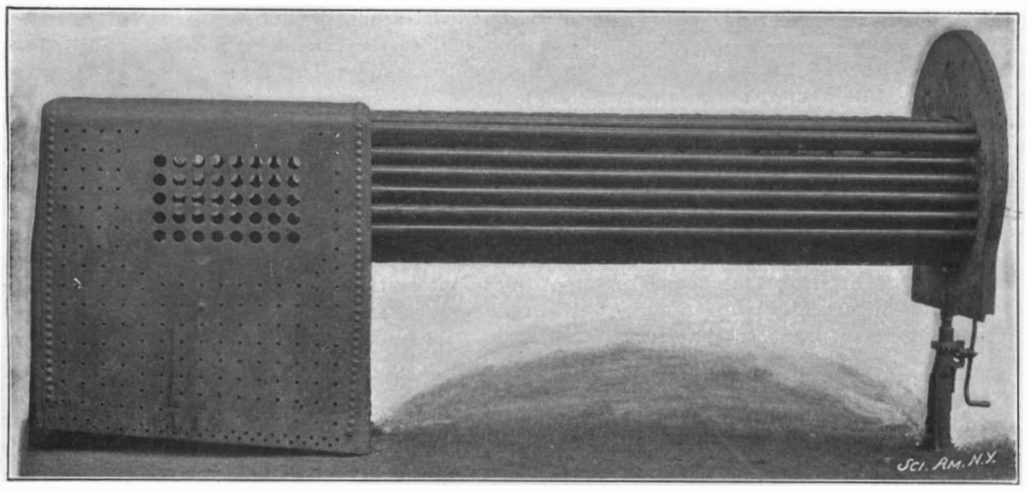
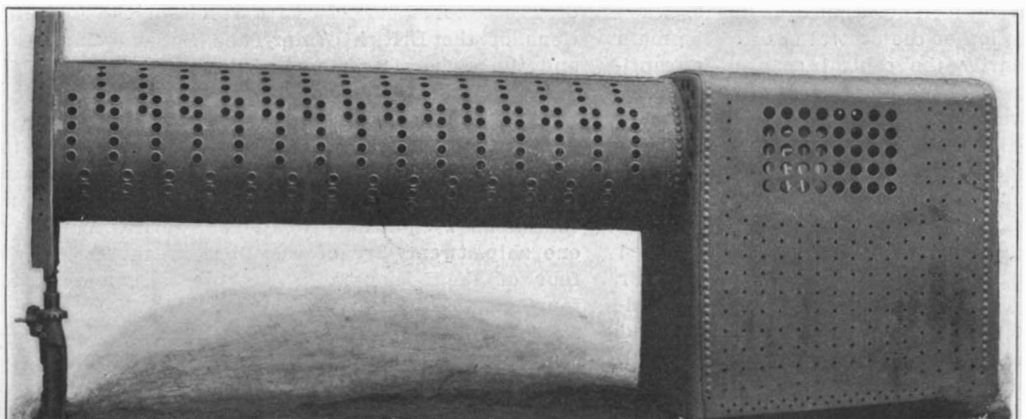
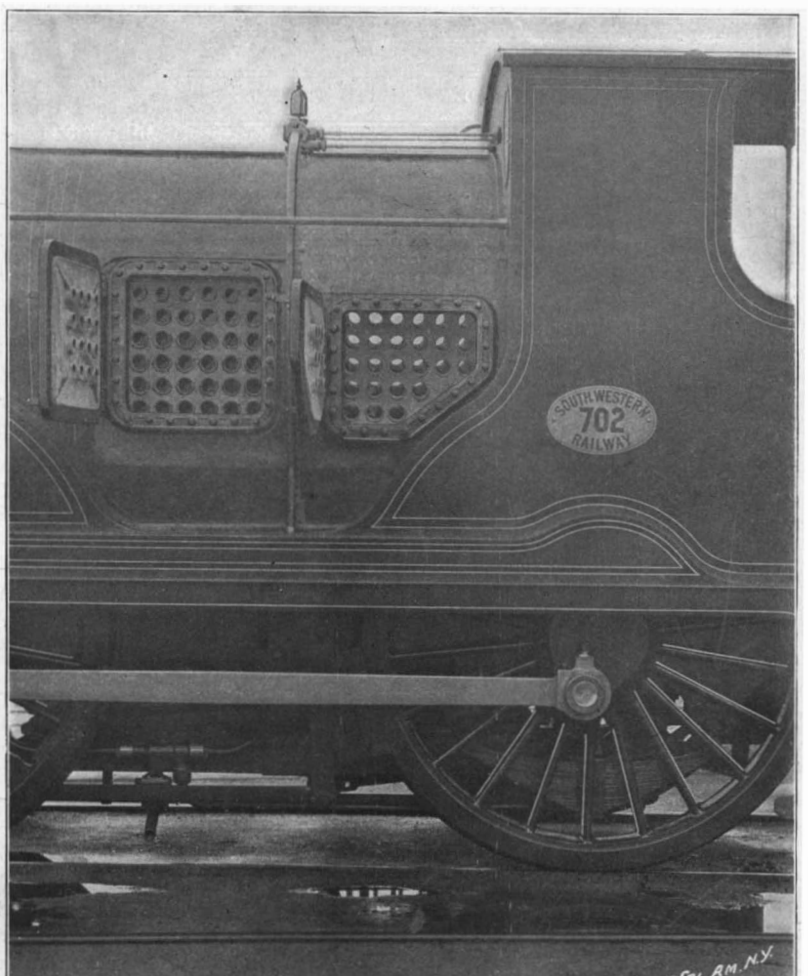


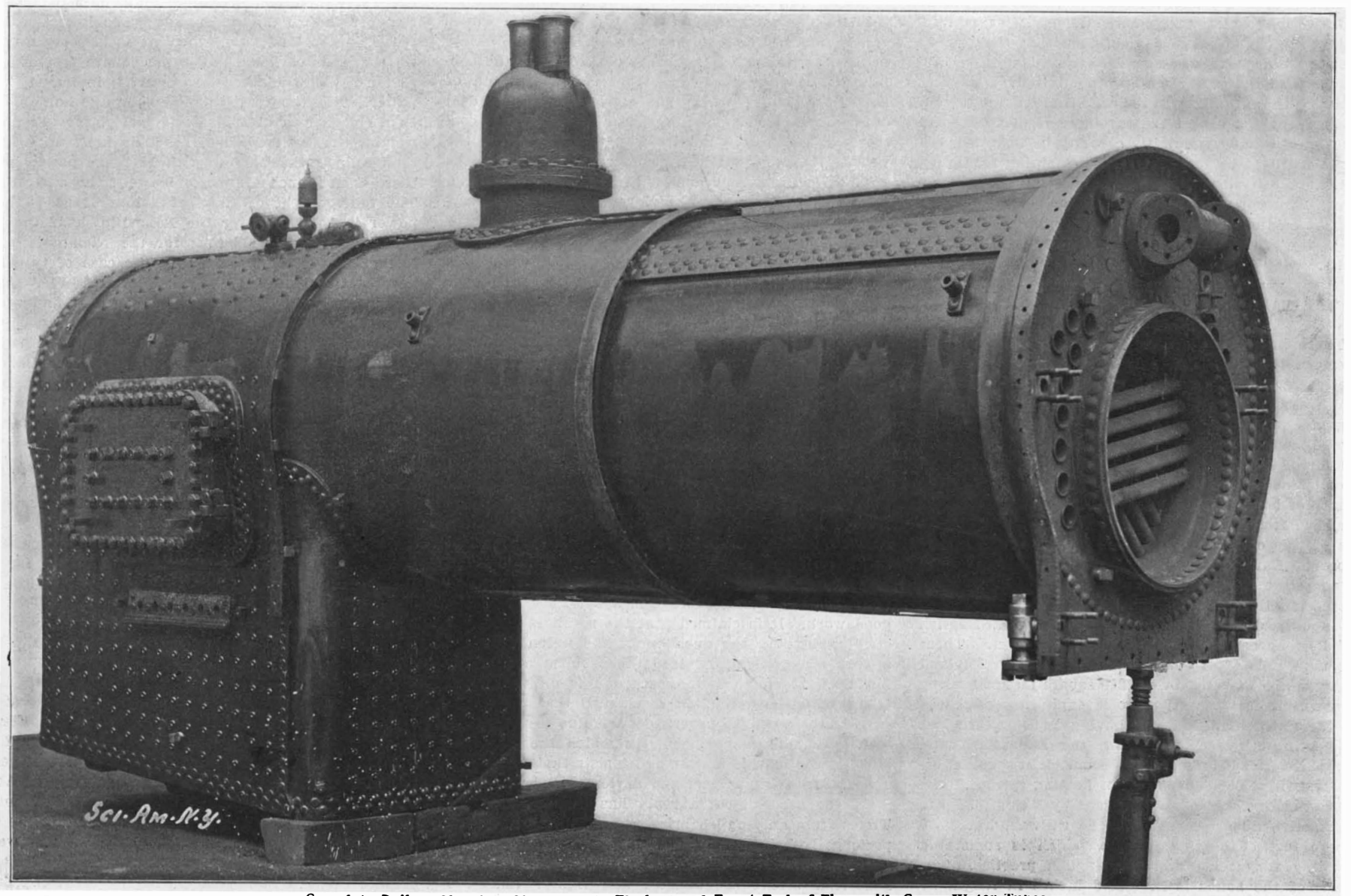
View Showing Auxiliary Fire-Tubes for Stiffening Front End of Firebox.



The Firebox and Water-Tube Flue.

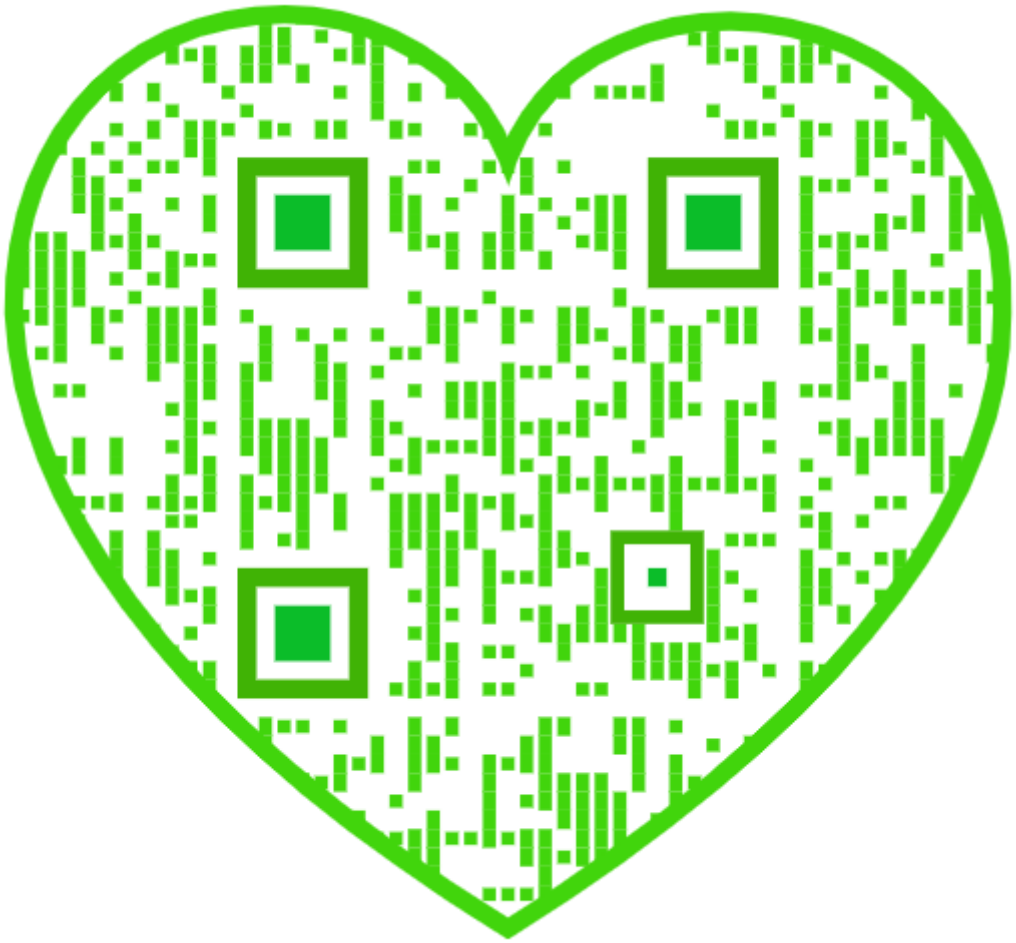


Side Doors Open, Showing Cross Water-Tubes in Firebox.



Complete Boiler, Showing Side Door to Firebox and Front End of Flue with Cross Water-Tubes.

AN ENGLISH WATER-TUBE LOCOMOTIVE BOILER.—[See page 256.]



SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, APRIL 12, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE LATEST STEAM TURBINE PLANT.

After a careful investigation in Europe and America of the performance of the steam turbine, the consulting engineer of the Cleveland, Elyria and Western Railway, Cleveland, has given orders for the installing of steam turbines for driving the generators in the new addition to the power plant of that company. Orders have been given for two 1,500-horse power Parsons turbines, which are to be direct-connected to two 1,000-kilowatt, two-pole, 400-volt, 25-cycle Westinghouse generators. These turbines will embody the fruits of the experience that has already been gained with the turbine both here and abroad. It is significant that the Westinghouse Machine Company, which is building the turbines, guarantees that with 150 pounds steam pressure and 100 degs. F. of superheat at the throttle, and 28 inches of vacuum at the exhaust, the steam consumption shall not exceed 10.08 pounds per indicated horse power, while at half load they guarantee that the steam consumption shall not be more than 15 per cent greater than the consumption at full load. The most interesting novelty of these machines is that they will consist of two separate sets of cylinders, high and low pressure, these being, of course, on the same shaft as the generator. The superheated steam is first led to the high-pressure cylinder, and then passes through a reheater which is hung in a pit below and parallel to the axis of the turbo-generator. This reheater is 3 feet 4 inches in diameter and 23 feet 6 inches in length. As illustrating the great economy of space and foundation work, due to the substitution of the turbine for the ordinary reciprocating engine, it may be mentioned that the present station would have been crowded, had the addition consisted of only two 500-kilowatt alternating current units with an ordinary reciprocating engine drive; whereas by the use of the turbine sets, not only can two units of 1,000 kilowatts capacity be installed, but there will still be sufficient space remaining for an additional 2,000-kilowatt unit. There is also great economy in the construction of foundations, etc., since the perfect balance of the turbine in running obviates the necessity for heavy masonry and holding-down bolts.

THE LARGEST LOCOMOTIVE ENGINE IN GREAT BRITAIN.

There has recently been constructed at the Great Western Railway Works, Swindon, a passenger locomotive which has reached the limit in height and width available on English railways, where the loading gage places rather severe restrictions upon locomotive dimensions. The height from the rail level to the top of the smokestack is 13 feet 2 inches, the width over cylinders 8 feet 11 inches, and the height of the center of boiler above the rail is 8 feet 6 inches. As we have frequently pointed out, the locomotive builders of this country have had a great advantage over those of Europe in the fact that they have realized at the start that the point at which to commence in increasing the power of the locomotive is the boiler. It is only during the last few years that English builders appear to have realized this fact. There are thousands of express engines running in England to-day which have not over 1,200 square feet of heating surface. A few years ago some engines were placed on the Caledonian Railway having 1,500 square feet of heating surface, and later the Lancashire and Yorkshire Road brought out some four-coupled expresses with 2,050 square feet of heating surface. The present engine, which was designed by Major W. Dean, Locomotive Superintendent of the railway, has 2,400 square feet of heating surface, which is something certainly very remarkable in English practice. The barrel of the boiler is 14 feet 8 inches in length by 60 inches in diameter, and the Belpaire firebox is 9 feet in length. The grate area is 27¾ square feet, and the working pressure 200 pounds to the square inch. The six-coupled driving wheels are 6 feet 8½ inches in diameter, and the outside cylinders will be 18 inches in diameter by 30 inches stroke. The engine weighs 72 tons, and the engine and tender together 118 tons. The tender carries 5 tons of coal and 4,000 gallons of water. The tractive force of the new engines amounts to 121.5 pounds for every effective pound of steam pressure. The most curious feature of this engine is the extraordinary ratio of stroke to cylinder diameter; for at a time when 3 to 4, or say 18 inches diameter to 24 inches stroke, is standard practice Mr. Dean has raised his stroke until the ratio is 3 to 5. We presume, however, this is due to the restricted width of the clearing gage, which prohibits the use of outside cylinders more than 18 inches in diameter.

A NOVEL METHOD OF BRIDGE ERECTION.

The natural tendency of the American engineer to seek the most direct way to the accomplishment of his work has been strikingly illustrated in the development of American bridge-building, where, indeed, it has led to the origination of a distinct type of bridge known as the pin-connected, in which the intersecting members at the joints are assembled on a common central pin, thereby greatly facilitating the cheapness and rapidity of erection. Concurrently with the development of this type, there was produced the "traveler," an ingenious portable derrick, or system of derricks, by which the bridge members are picked up and swung into place by the bridge gang. In the construction of cantilever bridges, and sometimes of long bridges made up of successive disconnected trusses, we have carried the method of construction by overhang to a great degree of perfection. Recently in the erection of the Highland Park highway bridge, at Pittsburg, a decided innovation was made, when it came to the erection of the central span of the main cantilever. Ordinarily the central span of a cantilever is erected by overhang until the two halves meet. In this case, however, the central span, 150 feet in length, was erected upon a large scow, towed to position below the overhanging arms of the cantilever, and then drawn up from the scow through a distance of 80 feet by means of tackles attached to the top chords of the truss. One set of tackles was suspended from the traveler booms, and the other from a pair of derricks set up at the ends of the opposite cantilever arm. The economy of this method in time and material is evident when we remember that, had the span been erected by overhang, its members would have had to be reinforced to take the erection strains, and special adjustments would have been necessary at the expansion joints.

AMERICAN METHODS FOR ENGLISH WORKMEN.

There was recently published in the London Times a letter from the building manager of the Westinghouse Manufacturing Company, dealing with the subject of the amount of work that can be got out of British workmen, which has attracted a great deal of attention in England, and has stirred up a controversy that has found its way to this side of the water. It seems that in the construction of the works of the Westinghouse Company at Manchester, England, British bricklayers were employed for laying the several millions of bricks required in the construction of the various shops. The contract was carried out under an American manager, who used the same methods that he employed in the erection of the Westinghouse factories at Pittsburg; and, according to the writer of the letter, the result has proved that it is possible to get as rapid work out of the English workmen as out of the American. Certain Proceedings of the Works Committee of the London County Council, recently published, have shown that the average London bricklayer considers that if he lays 400 to 500 bricks he has done a fair day's work. The average number laid per day in Manchester is not very much higher; but under the system employed by Mr. Stewart it seems that the British workmen laid bricks at the rate of 1,800 a day, and that on the commoner class of work, for which less care was required, they reached as high a figure as 2,250 bricks a day. This is taken to prove that the British workman can do as well as the American, whose average is about 2,000 bricks on good work. It is claimed that the result is the more striking because the question of the union does not appear to have entered into the problem at all, for Mr. Stewart employs unionists and is on very good terms with the union. It is claimed that the difference in the amount of work done is due to the American system of management, in which the employer and not the man is master and insists that every possible labor-saving system and device shall be used.

On the other hand, a reply has been sent to the Times from an English bricklayer, with extensive experience both in England and America, who says that the comparison is misleading, for the reason that the American bricks are smaller and lighter than the British bricks. The brick used in this country is 8 inches long by 4 inches deep and 2¼ inches in thickness, and it takes, according to the writer, 1,170 to equal in measurement 880 English bricks; furthermore, he states that, working in America, bricklayers who have been paid a dollar a day more than the union rate have given satisfaction when they set from 500 to 700 bricks a day, according to the quality of the work. This, on the other hand, is explained by a correspondent on this side of the water, who states that the lower rate quoted refers to the men who lay the fine facing pressed brick, which requires special skill and care. An English contemporary, commenting on the controversy, explains the discrepancy by saying that for the rougher class of work, of the kind for which the Westinghouse manager claims such a high record a day, it is customary in this country to use a much wetter mortar than is used in Great Britain, and this enables the bricklayer not only to spread his mortar more rapidly, but to set the bricks with a single tap of the trowel instead of having to hammer them down into place, as is necessary with the stiffer mortar used by the British workman. It is probable that the truth of the matter lies, as usual, somewhere between the two extremes.

A COMPARISON OF WATER-TUBE BOILERS.

A most interesting opportunity for comparison of the relative efficiency of various types of water-tube boilers will be afforded in connection with this year's shipbuilding programme of the British Admiralty, because of the determination of this body to install four different systems of water-tube boilers in the five new armored cruisers which are to be built. These vessels, four of which will be constructed in private yards, and the fifth by the government, are to be of something over 10,000 tons displacement, and are to be driven at a speed of 23 knots an hour by engines of 22,000 horse power. As a result of the investigations of the British Water-Tube Boiler Commission, and the elaborate tests carried out by them on the "Minerva" and "Hyacinth," full accounts of which have been given from time to time in the SCIENTIFIC AMERICAN, the government has decided to test the Belleville, the Yarrow, the Dürr, the Niclausse, and the Babcock & Wilcox boilers under exactly similar conditions by putting twenty-two Yarrow boilers in one ship, twenty-five of the Dürr in another, thirty-four of the Niclausse in a third ship, and in the fourth and fifth twenty-five Babcock & Wilcox boilers. As several of the "County" class cruisers now under construction, which are practically of the same type, are to have the Belleville boiler, an excellent opportunity is afforded for comparison. The steam pressure in the case of every ship will be the same, 250 pounds to the square inch at the throttle valve. The greatest heating surface per unit of power is shown by the Yarrow boilers, in which it amounts to 3 square feet per indicated horse power. The lowest ratio is found in the Belleville, where it is 2.29 square feet. On the basis of horse power per square foot of grate surface, the Niclausse shows 12.2 indicated horse power, while the Yarrow boiler shows 20 horse power. In a comparison of indicated horse power per ton of weight, the Belleville boiler stands first, with 12.57; then follows the Yarrow with 12 horse power, while there is not much difference between the other three. The total weight of the installation of 22,000 horse power is 1,750 tons for the Belleville, 1,832 tons for the Yarrow and 1,892 tons for the Niclausse, which is the heaviest of the five. In the case of the three new battleships of the "King Edward VII." class, which are to be 16,350 tons displacement and are to have a speed of 18½ knots with 18,000 horse power, Babcock & Wilcox boilers are to be adopted in two of the ships and a combination of three-fifths Babcock & Wilcox and two-fifths cylindrical boilers is to be installed on the third ship. In these vessels also it is possible to institute a comparison of the new water-tube types with the Belleville boilers, since the engines of the new ships will be very similar to those of the preceding battleship class of the "Duncan" type. The total weight of the Belleville boilers of the "Duncan" class is 1,580 tons; of the Babcock & Wilcox 1,735 tons, and of the combined types 1,885 tons; the indicated horse power per ton of machinery being 11.4 for the Belleville, 10.37 for the Babcock & Wilcox, and 9.54 for the combination.

FRENCH RAILWAY ENTERPRISE IN ABYSSINIA.

In the report on the Somali Coast Protectorate, the British Consul at Zaila describes at great length the possibilities of developing trade with Abyssinia by the construction of railroads, and particularly the French enterprise in this direction. Until recent years Zaila was the chief port for the import and export of goods to and from Harrar. Harrar is the gateway of Abyssinia, and the point from which that country communicates with the Somali coast. Notwithstanding the disadvantages of Baila as a port, and the want of water near the town, a thriving trade is done, all goods passing between Zaila and Harrar by caravan. Zaila is an old Egyptian town, and remains unaltered. With the exception of a few unpretentious government buildings, British ownership has made no outward change.

The French government established a colony at Obok, and thence quite recently moved it to Jibouti, which a few years ago was a mere stretch of desert coast, but which, by the lavish expenditure of money, has now become an important town. It still grows, money is still forthcoming, and Jibouti looks to the future for its return.

Zaila has for numberless years been the point of departure for caravans for Abyssinia. It occupies the same position as before. No caravans ever started from the site whereon the new town of Jibouti now stands. In Zaila the British government has done nothing beyond watch over the caravan route and insure peaceful passage for all who use it. The old order of things continues under circumstances of improved security and a protection on which it is safe to rely. Eastern methods of transportation endure, but the British government protects it.

Jibouti, on the other hand, is a port newly established for the development of western improvements. Modern enterprise has subscribed capital to construct a railroad from the coast and secure the trade with Abyssinia. The enterprise is sound, but, like all undertakings in unknown countries, it has met with difficulties and delay. The country through which the line had to be made was waterless and studded with rocks. Want of funds frequently interrupted the progress of construction. Hostility on the part of the fierce Somali tribes, who gave no welcome to a substitute for the transport provided by the hire of their camels, was, perhaps, as great a source of trouble and loss as either of the others named. However, there is at present, in Jibouti, a large railway station of a size and importance sufficient to represent the existence and establishment of the most paying line in any country, and the rails have been excellently laid for 165 kilometers. The construction has now entered Abyssinian territory, where protection and control are beyond the hands of the French government.

When the railway is completed, if it succeeds, a great boon will have been bestowed upon all those who trade with Abyssinia, since that country may be opened up; but Abyssinians do not appear to be greatly attracted by European products. Till now there has been little demand for aught save rifles, revolvers, and cotton goods, among the inhabitants of Abyssinia. At present, however, there is a disposition on the part of merchants to make use of the railway. From the terminus now reached camels must be engaged and a caravan formed to continue the journey to Harrar. There are signs that this trial of the railway is premature, and cases have occurred and continue to occur, where goods dispatched from Zaila, though leaving subsequent to those sent by rail, have arrived in Harrar first. However, this is a matter which the merchants will inevitably discover themselves. The Zaila route, though known to be slow, is also known to be sure. For the present it must be expected that all traders will wish to try the railway, and a time of depression for Zaila is certainly near at hand. Then the caravans will depend on local trade, and that which is provided by a few conservative Arabs who prefer old ways to new.

THE EXPANSION OF WINTER FARMING.

BY GEORGE E. WALSH.

The idea prevalent in some quarters that agriculture has not kept abreast of modern industrial developments is so far from the actual truth that occasionally the public is surprised by reports which indicate a change and revolution in methods and results of a most phenomenal character. In nothing has our agriculture changed more decidedly in recent years, however, than in the seasons of production. Science has deliberately set at defiance all the laws which govern the seasons of growth, and in the conflict it has proved a great triumph for man. Winter farming has become in the past decade an industry more profitable and successful than ordinary summer gardening or farming.

The demand for farm products in winter, when most of them are scarce and difficult to secure, has been responsible for the growth and expansion of winter farming. To-day this industry is of national importance, and adds millions of dollars to the wealth of our country. Lands that were formerly considered almost worthless have attained through this industry considerable value, and farmers who were disappointed at the outlook of their profession have suddenly discovered new means of reaping financial rewards for their labor and genius. Instead of following in the old ruts in vogue fifty years ago, they have branched out in entirely new lines to develop an industry that is as fascinating as it is profitable.

Naturally one thinks first of truck gardening, either under glass in the North in winter or along the belt of Southern States, when this subject is broached; but winter farming is not by any means confined to even this field. Winter dairying has become in the last five years one of the most profitable sources of farming, and it is pursued by the most progressive dairymen of the country with great success. By means of the silo, succulent food is stored away for winter feeding that produces almost as fine milk and cream as the June grass. The milk and cream in winter time are worth so much more than in summer that the dairymen find it profitable to provide good winter quarters for the best cows and to feed them with the best food.

The poultry farmer has likewise changed his methods, and by means of the incubator and brooder winter and spring broilers are produced to-day in enormous quantities for our tables. Winter poultry is to-day about the only product of the chicken farm that actually pays a good profit. The high prices obtained for spring chickens and broilers out of season have caused complete changes in this industry. Those who depend upon the eggs for their profits are endeavoring to induce the hens to change their season of laying, so that winter eggs will be had in abundance. Extensive experiments in winter feeding and winter breeding in glass-covered houses have produced results which encourage the poultrymen to believe that eventually breeds of hens will in time be reared which will lay their eggs in winter instead of summer. At present the results obtained are not entirely satisfactory.

Hothouse lambs have become important parts of our winter diet in recent years, and breeders have established enormous houses where these delicate animals can be reared and fattened through the coldest of our winter weather. The work is profitable, and the breeders are increasing the industry each year. Hothouse lambs are delicacies out of season at present, but in the future they may become an ordinary part of our regular winter diet.

Hothouse fruits and vegetables multiply in quantity and quality every year. The industry is expanding so rapidly that the annual winter supplies of these delicacies are running up into thousands of tons. Around Boston there are several hundred acres of land covered with glass where fruits and vegetables are raised for the winter markets. Jersey and Long Island are also centers of this industry, and hundreds of acres are now under cultivation right through the winter. These hothouse products bring high prices all through the winter, and from two to four crops are raised annually on the same land. In the spring, when the weather grows warm, the glass sashes are removed, and the plants for the summer markets are raised as easily as if the land had not been producing all winter. When the cold autumn frosts come, the glass sashes protect the new crop that has been planted for the Christmas holiday seasons. Then when these winter products are harvested, seeds for an early spring crop are sown, and by the time Easter is here fresh vegetables are again ready for picking.

The truck products raised under glass in winter receive the most modern intensive culture. The soil is of the richest, well heated by steam pipes, moistened properly, and sometimes lit artificially at night time by arc lights. The electric light tends to stimulate the growth of certain vegetables, and the season of maturity is thus rapidly hastened. The profits from this business often run from 50 to 80 per cent on the investment, and during the rough winter weather when Southern truck cannot reach the markets, prices for the vegetables raised under glass soar up to almost fabulous prices. Yet in spite of the great number of acres of land covered with glass and devoted to winter farming, the supply hardly keeps pace with the increasing demand, and there is ample opportunity for further expansion in this line.

Winter gardening and farming in the southern belt of States where the climate is warm enough to produce the products out of doors have spread with phenomenal rapidity in recent years. Whole sections of States have been reclaimed by this industry, and land that was worth only a few dollars an acre ten years ago sells to-day for two or three hundred dollars an acre. Our whole system of living and diet has been transformed by this industry, and our winter season is supplied with fruits and vegetables almost as freely as the summer.

The expansion of this form of winter farming has been due to the railroads and steamship companies operating lines along the coast or through the belt of States with climate and soil suitable to the business. The construction of refrigerator cars which would enable growers to ship their strawberries and tomatoes from Florida and Louisiana to New York or Boston in midwinter gave a great stimulus to the industry. It is now possible to land the most perishable fruits and vegetables in New York from the most distant gardens within seventy-two hours after picking and in perfect condition. Each year the source of the supply is extended. It was first the Carolinas, Norfolk and Georgia which monopolized this industry. Then Florida entered the field, and finally the gardens spread along the Gulf and included those in the Mississippi Valley. California made special efforts to ship her fruits and vegetables to Eastern markets in cars made for the purpose, and now Texas and even Mexico are entering the field with their peculiar farm products. There are some 60,000 refrigerator cars engaged in this traffic in the winter season, distributing the fruits and vegetables of the tropical and semi-tropical gardens and farms to the large cities of the North, South, East and West. The best of these cars are scientific products of modern genius, and they carry their loads of fruits as carefully as a Pullman palace car transports its millionaire occupant.

Strawberries from the Carolinas alone amount to some 12,000,000 quarts a year, while California pours across its borders some 193,000,000 pounds of fresh fruits. New York city alone absorbs some 4,000,000 packages of Southern vegetables every winter. All told, the winter farming which supplies the cities with their fruits and vegetables in the cold season represents an industry mounting up into many millions of dollars. All this is pure gain for the farmers and land owners, who formerly made little or nothing from the soil which is now brought under contribution to feed us with a winter diet of fruits and vegetables. The creation and expansion of the industry represents wealth added to the country just as surely as if new gold mines had been discovered which yielded annually a dozen million dollars' worth of the precious metal.

SCIENCE NOTES.

Prof. Charles Wilson has announced to the Royal Society a new determination of the temperature of the sun. His figures are 6,200 deg. C. (11,192 deg. F.). It is stated that the absorption of the sun's atmosphere probably makes this temperature equivalent to 6,600 deg. C. at the surface.

Tests made of aluminium bronze at the Zurich Polytechnic show that the specific gravity rises and falls as the percentage of aluminium is increased or decreased. For soft alloys the maximum strength was obtained with three and four-tenths per cent of aluminium, for hard alloys with one and four-tenths per cent of aluminium. The addition of silicon increased the specific gravity, but reduced the elasticity. Iron added was not observed to alter the characteristics of the alloy in any great degree.

Near the River Ebrosowka, eastern Siberia, Dr. Herz states that he discovered a huge mammoth preserved in the ice. The animal had assumed a reclining position with its feet peculiarly bent beneath its body. Dr. Herz inferred that it had fallen down a declivity and had been instantly killed. Grass was found in the mouth of the animal, and food in its stomach. Two thousand years elapsed since that last mouthful of grass was torn from the sod. The animal was covered with a coat of rather thick, red-brown hair.

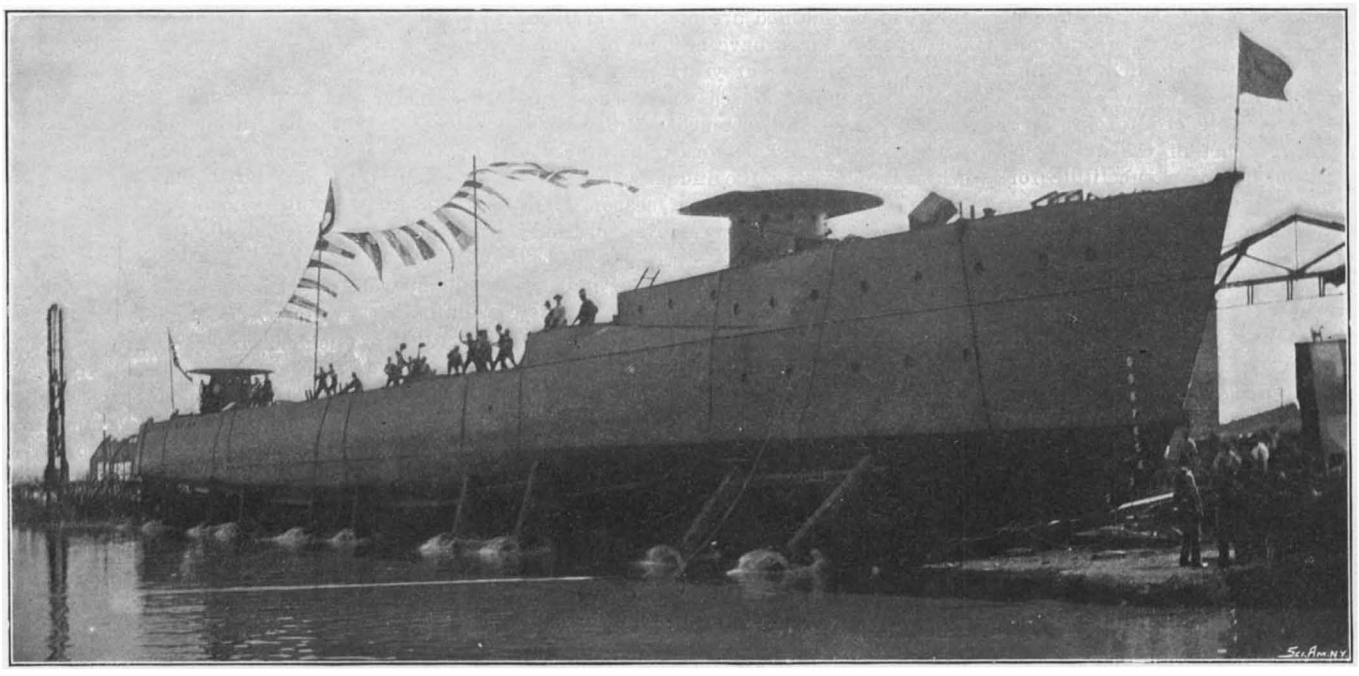
The steamship "Afridi," which dropped anchor in New York Harbor on March 23, brought with her a collection of rare animals for the New York Zoological Gardens. Among them is a three-year-old hairy-eared rhinoceros, one of the only four known to be in captivity; four bears from Korea and Japan; nine monkeys of the red-faced Japanese breed; one fox, one raccoon, two silver badgers, one sand badger, one wild boar, two yellow martens, one lynx, two civet cats, four salamanders, two peacocks, and six parrots. A valuable orang-outang, three gibbon monkeys and a leopard died on the voyage.

The British government has just completed the survey of the English section of the Victoria Nyanza, in central Africa, for the establishment of a steamer service on the lake in connection with the Uganda Railway, which has recently been completed. The surveying has occupied thirteen months and was carried out by two surveyors in two small steel boats. Every part of the British shore of the Nyanza was explored, aggregating over 2,200 miles of coast line, mainland, and islands. The latter have been accurately charted for the first time, and in parts the maps of the lake shore have been altered from their existent physical condition. The lake is studded with a very large number of islands of varying sizes, many of them densely populated. The British portion of the lake is about 135 miles from east to west, and about 90 from the north to the Anglo-German boundary, excluding the eastern gulf, 40 miles long, which has now been properly mapped. The lake is constantly subject to storms, which render it dangerous to navigation. Owing to this fact, and the smallness of the boats, it was not thought advisable to visit three small islands which were visible far out in the lake, but with these exceptions every island has been visited and mapped by the expedition. During the journey the surveyors discovered several islands inhabited by savages. Even some of the tiniest rocky islets were found to be tenanted by fishermen. Preparations are being made for the development of the lake traffic with the opening of the railway, and passengers leaving the train at Port Florence, on the lake shore terminus of the railroad, will step on board twin-screw steamers alongside the jetty, which will convey them to the different stations. One of the steamers for this service has already left England, and should be on the lake by June. Another steamer will follow. These vessels are each 175 feet in length and draw 6 feet of water.

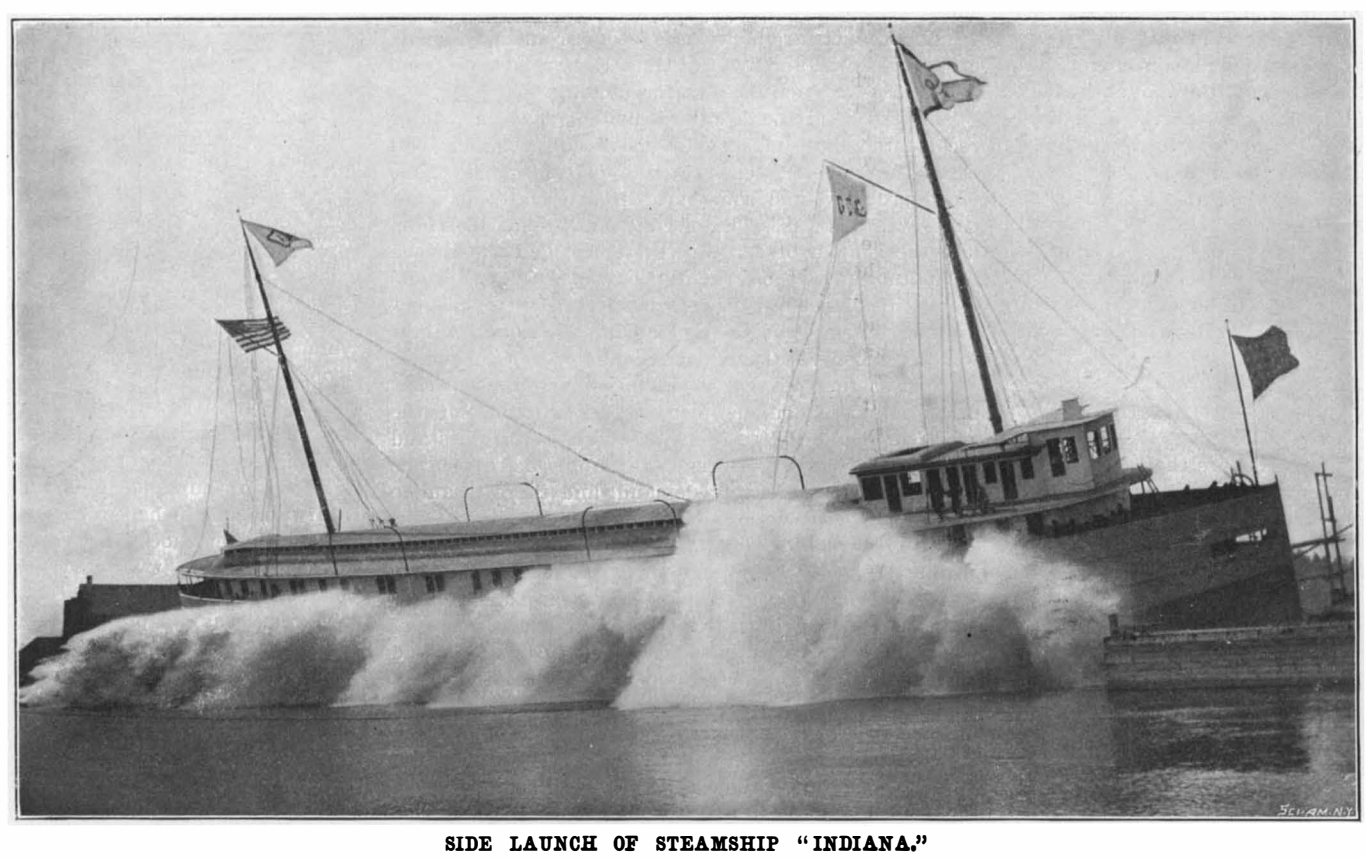
BROADSIDE LAUNCHINGS.

BY WALDON FAWCETT.

The launching sidewise of steel vessels of large dimensions is distinctively an American practice. The development of the idea in its application to vessels of considerable size has occurred on this side of the Atlantic, and indeed this is the only country where the plan is followed to any considerable extent. Broadside launchings have always been the rule at the shipyards on the Great Lakes, and of late years have been introduced to some extent in shipbuilding plants on the Atlantic coast. The side launching is not claimed to have any advantage over the more common mode of getting a new hull into the water, but the adoption of the method has been dictated by limitations in the depths and areas of the waterways which has been available for launchings at the shipyards where this scheme has been employed. In other words, a vessel may by means of the broadside method be launched into a slip or river so shallow and narrow that the reception of the hull would be practically impossible were it sought to slide the vessel into the water endwise, as is the custom at yards possessed of a generous extent and depth of water.



SIDE LAUNCH OF TORPEDO-BOAT DESTROYER "DECATUR."



SIDE LAUNCH OF STEAMSHIP "INDIANA."

The ways utilized in a broadside launching are, of course, dissimilar in many respects to those employed in the ordinary end-on launches. In the first place, the groundways for use in an endwise launch must necessarily exceed to some extent the extreme length of the vessel, whereas in the case of the side launch the groundways may not represent 5 per cent of the length of the vessel which travels over them. For a 500-foot vessel to be launched in the ordinary manner ways 550 feet or 600 feet in length might be necessary, whereas for launching a 500-foot vessel broadside groundways of 20 or 25 feet should prove sufficient.

The groundways are usually of yellow pine, 12 by 12 inches in size, and have an inclination of approximately two inches to the foot. The plan followed in the shipyards on the Great Lakes is to so gage these groundways that the ends, carefully rounded, will just reach the water's edge. The natural result is that it is necessary for the vessel being launched to literally drop from the end of these ways into the water. The vessel is certain to turn slightly on her bilge as she travels down the ways, and the impetus of the plunge from the ways adds to the force with which the great hull careens. Very frequently the ship would go over on her beam ends—"turn turtle" as the marine men say—were it not for the heavy checking lines which extend from shore to the stem and stern of the boat. The sudden impact of so large a craft in a shallow body of water causes the tidal-like wave which is raised by the vessel and which forms one of the picturesque features of a broadside launching.

In the lake shipyards the vessels are built on level stocks, and the cradles on which the vessel rests, as well as the sliding ways on which it travels, are usually constructed of pine. For greasing the ways in order to facilitate the movement of the vessel there is employed a mixture consisting of one part of grease to five parts of beef tallow. This proportion is varied considerably, however, owing to the condition of the weather, and after the mixture has been applied the ways are given a coating of lard oil. The manner of wedging up the vessel and removing the blocking preparatory to launching do not differ materially from the practice in vogue at yards where the end-on method of launching is employed exclusively.

There appears to be almost no limit to the size of vessel which may be successfully launched broadside, as several vessels, each approximately 500 feet in length, have been placed in the water in this manner. It is essential that both ends of a vessel shall start at exactly the same time and that the hull shall travel evenly down the ways, otherwise a very severe strain is imposed; and inasmuch as the lake vessels are of great length and comparatively narrow beam, this might be attended by serious consequences. A majority of the vessels which are set afloat on the Great Lakes, in accordance with the practice outlined, are launched when not more than two-thirds completed, and before any portion of the machinery installation has been placed aboard; but this ingenious method of launching has been successfully employed in the case of vessels with engines, boilers and every detail of equipment complete, and which were ready to go into commission within a few hours after the launch.

As has been stated, the broadside method of launching has been employed in several shipyards on the Atlantic coast, notably at the plant of the William R. Trigg Company, at Richmond, Va., where the torpedo boats "Shubrick," "Stockton," and "Thornton" and the torpedo-boat destroyers "Dale" and "Decatur," all building for the United States government, were slipped into the water in this manner. The action of the Trigg Company in adopting the sidewise method of launching was prompted by the same necessity which impels such procedure on the Great Lakes, namely, limitations of room for launching purposes. At Richmond it was necessary to launch into a canal 100 feet in width and not exceeding 18 feet in depth.

The launching plan as evolved at the Southern shipyard presented some modifications of that followed at the shipbuilding establishments along the northern border of the country. For instance, instead of the groundways ending at the water's edge, as they do in lake shipyards, the groundways for the torpedo craft were carried down well under the water, and the boats were thus entirely water-borne before leaving the ways. It was claimed that this saved considerable strain on the hulls during launching. The groundways, consisting of four groups of two each, the spacing between the members of each group being 15 feet, were fewer in number than would have been employed in launching a vessel of equal size on the Great Lakes. After the blocking had been removed, the vessel to be launched was held in place by four trigger ropes, and to start the hull on its journey to the water it was only necessary to sever these four ropes simultaneously. The really unique feature in connection with the launchings at Richmond is found in the methods employed in gradually lowering two of the vessels distances of 30 and 32 feet respectively to positions formerly occupied by other vessels, in order that the launching process proper might not present a necessity for so great a distance of travel to the water. This was accomplished by means of 8-ton screw jacks, of which two were provided for each cradle. The positions of these jacks were so arranged that one was always about a foot in advance of the other, and after one set of jacks had been backed down as far as possible the vessel was held in place by the other jacks, while those whose limit of immediate usefulness had been reached were removed. After they had been replaced at a point lower down the lowering operation was resumed until it became necessary to shift the other jacks, and so on.

In some instances difficulty has been experienced in starting the vessels, and it has been necessary to use rams; but this is exceptional, and there is practically no danger that once the vessel has started it will, as is sometimes the case in end-on launchings, become so firmly lodged at a point on the ways that a postponement of the launch is necessary.

Tensile Strength of Bronze.

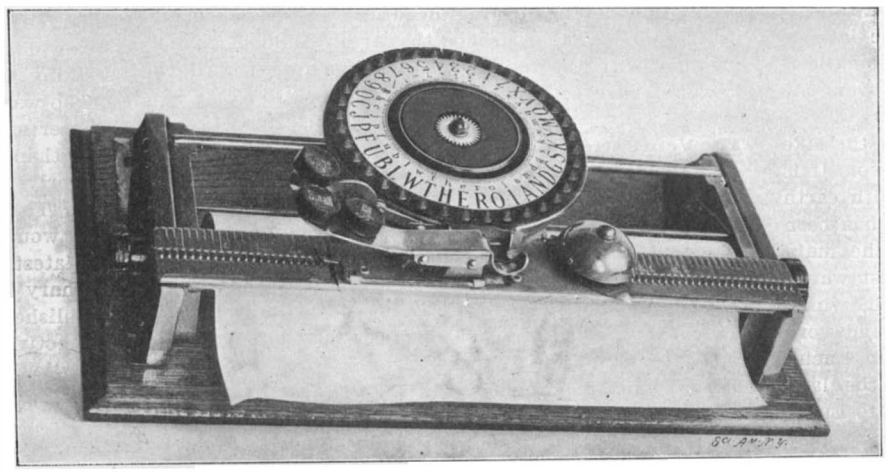
Prof. C. Bach, of Stuttgart, has made an investigation of the effect of temperature upon the tensile strength and ductility of bronze. When the temperature exceeds 400 deg. F. both of these important properties decreased astonishingly. The alloy experimented with consisted ot copper 91 per cent, zinc 4 per cent, tin 5 per cent. The reduction of strength and ductility at 400 deg. F. is about 6 per cent, but at 600 deg. F. about 50 per cent. Since the alloy tested elongated but little, it may be considered safe for use in connection with steam at ordinary pressures. For valve bodies, stuffing boxes and the like, or other parts coming in contact with highly superheated steam, the metal would probably be not fully trustworthy.

THE IMPROVED SIMPLEX TYPEWRITER.

In the SCIENTIFIC AMERICAN for March 31, 1900, we described a cheap form of writing-machine, which was designed to place within the means of the tradesman whose correspondence did not warrant the purchase of an expensive machine, a typewriter that would do all that could be reasonably expected. That thousands of these machines are in use shows how quickly their merits have been recognized. Since the appearance of the article in question the makers have improved the construction in important particulars.

The novel feature of the printing mechanism of the new machine is to be found in a shifting device of simple form, by means of which a speed can be obtained that overcomes the chief defect of the ordinary printing-wheel typewriter.

The capital and small letters, placed side by side, are formed on an elastic rubber disk, *A*, which is designed to be acted upon by superposed keys carried on radial arms, *B*, constituting a printing wheel. As in the old typewriter, the proper key is swung into printing position automatically, insuring a good alinement. In devising the new Simplex, the inventors have been concerned chiefly with producing a device, the equivalent of the shift key on the standard typewriters, whereby the printing-wheel, after the proper letter has been located, is automatically given a slight additional movement in order that the upper or lower case letter may be printed, without any supplementary manipulation of the printing wheel.



THE IMPROVED SIMPLEX TYPEWRITER.

The device in question includes a combined spacing and printing lever, which normally prints small letters by throwing a presser foot, *D*, down on the rubber disk, *A*, carrying the type, and which spaces, by means of a dog, engaging a rack. A shifting lever, *F*, connected with a slide, *C*, notched in its upper edge to receive a depressed key, brings the upper case letters

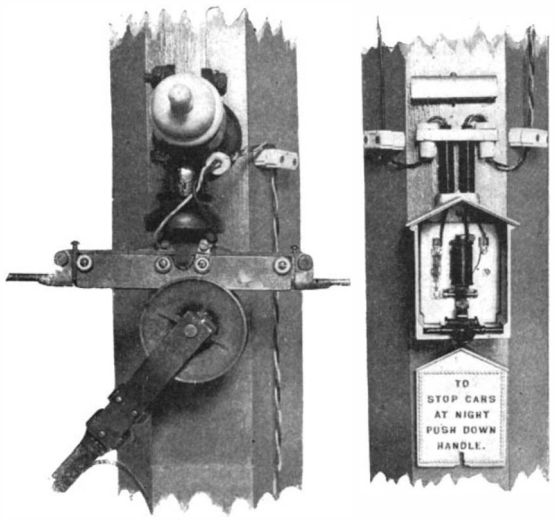


Fig. 2.—THE MECHANISM OF THE SWITCH.

into printing position, the lever, *F*, being designed to engage a projection on the spacing and printing lever in order that shifting to upper case and printing may occur simultaneously.

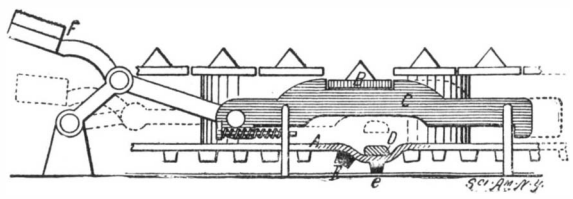
In printing a small letter, the finger is placed on the desired key, and with a lateral movement is swung into printing position, whereupon the spacing and printing lever is pressed down, and the small letter is printed by the presser foot, *D*. The act of depressing the lever causes the dog to engage a rack tooth and to push the carriage of the printing wheel forward one space. Hence printing and spacing are accomplished at one operation.

For a capital letter the depression of the shifting lever will push the slide, *C*, slightly to one side, causing the slide to carry with it the depressed key, thereby slightly rotating the entire printing-wheel so that the capital letter on the rubber disk is shifted around into printing position. The depression of the shifting lever also engages and operates the spacing and printing lever. Hence a single motion shifts, prints, and spaces. The slide, *C*, is returned by a coiled spring, thereby bringing the lower-case letters back into normal position.

The improvements described increase the speed and double the capacity of the simple finger disk typewriter, and impart to the machine all the characteristics of the large standard machines. Its construction gives capacity and strength in the most compact form, with a directness and ease of action that makes it serviceable and pleasing whether used in the business office, in the study, or when traveling. The manufacturers and patentees are the Simplex Typewriter Company, of 644 First Avenue, New York city.

NIGHT SIGNAL FOR TROLLEY LINES.

On suburban trolley lines, operating expediency makes it desirable that there should be some means of not only signaling the cars at night, but also of having a light at the stations while passengers are waiting.



THE SHIFTING MECHANISM.

Of course this can be and is done in many instances by having the conductor turn on the lights at dusk and permitting them to burn all night. This, however, is a matter of considerable expense for the mere item of the current consumed, and is a custom which can be followed only at the more frequently patronized stations, where the travel is great enough to pay for the outlay. To overcome these objections and to make it possible to have the most insignificant station lighted during its occupancy by prospective passengers, a device has been recently patented by Gwynne R. Painter, of Baltimore, Md., which he calls an electro-mechanical switch, that is a switch operated by the passenger and electrically reset by the passing car. These signals are already in use on the line of the United Railway and Electric Company, of Baltimore, and have been found to be eminently successful.

The process of giving the signal and lighting the station is such an easy one that the most simple-minded person can follow it out. All that is necessary is to follow the directions displayed, and these are "To stop the car at night, push down handle." This gives the signal to the motorman and sheds a grateful radiance around the waiting passenger. Once the signal is set, it cannot be extinguished except by the car itself. A little girl operating one of these signals is shown in Fig. 1. The switch, which is operated by the passenger, is incased in an iron box and is thoroughly insulated. It consists only of one magnet and an armature. The circuit of the device is shown in Fig. 3.

This magnet is 1 inch by 2 inches and wound with No. 26 wire. When it is in shunt with a 500-volt railway current passing through five 16 candle power lamps in series, as shown, there is only a difference of potential of 3 volts across its terminals. The short-circuiting device on the trolley which resets the switch after it has served its purpose is shown in Fig. 3. By reference to the wiring diagram (Fig. 3) it will be seen how the device operates. A wire from the trolley leads to one end of the magnet in the switch box. The other end is made fast to the frame and magnet core. It will now be seen that the circuit is broken until the armature is raised and touches the core, and when this takes place the current will then pass through the armature to the cluster of lamps and thence to the ground, completing the circuit. At the same time it causes the magnet to hold the armature to itself, causing the lights to stay lit. When the car arrives and the passenger has boarded it, the trolley wheel runs on this short-circuiting device, when the magnet will not hold the weight of the armature, and it drops back to its original position, thereby opening the circuit and putting out the lights.

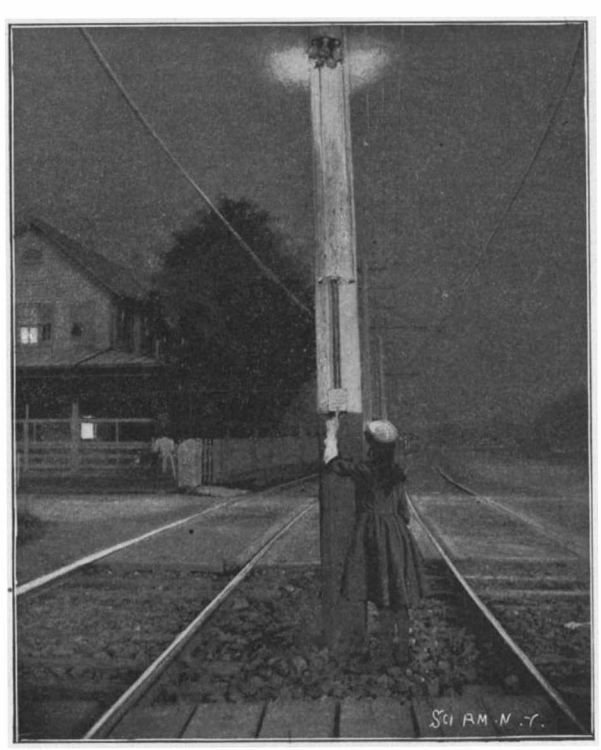


Fig. 1.—SETTING THE NIGHT SIGNAL FOR A TROLLEY CAR.

The drawing shows the contacts on the armature and magnet in the form of screws, so they can be renewed when they become injured from arcing, when the circuit is broken. In practice this was found unnecessary, as the magnet acts as a "magnetic blowout," and there is hardly a perceptible arc. The trolley wire is not cut in placing this resetting device, nor has it any moving parts to get out of order; and since, as before stated, there is never more than a difference of 3 volts between the two parts of the device, there is of course no danger from ice, rain, etc., depositing and causing any trouble or possible interruption. All the moving parts of the switch are reset by gravity, so that it is not likely to get out of order

Periodicals at the British Museum.

For some time past the question of providing accommodation for the ever-increasing numbers of newspapers which daily arrive at the Copyright Office of the British Museum, from all parts of the United Kingdom and the Colonies, has been under the serious consideration of the authorities. The room available at the Museum was practically exhausted four or five years ago, and the difficulty finally became so acute that last year it was decided to discover some remedy. An arrangement has now been completed by which the trustees of the British Museum have acquired a site at Hendon, a suburb about five miles distant from the Museum itself, some five and a half acres in extent, for the erection of a large building capable of storing newspapers for many years to come. The total estimated cost, including site, is approximately $90,000. An idea of the rate of increase of the collection of newspapers, for which storage room is at present so urgently wanted, may be gathered from the fact that the number of papers published in the United Kingdom alone received at the Museum in a year is 3,400, comprising 220,369 single numbers, while 226 sets containing 30,598 numbers of foreign and colonial newspapers are presented annually, and 75 sets containing 12 volumes and 15,140 numbers of current foreign and colonial newspapers represent the papers purchased in a year. By the new arrangement, upon giving two days' notice, any desired paper will be conveyed from Hendon to the reading room at the British Museum.

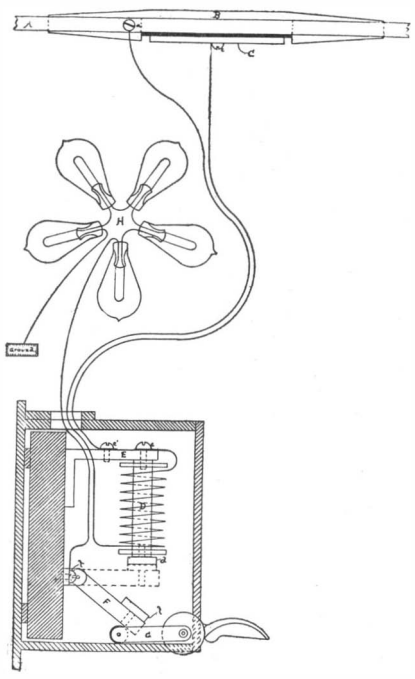


Fig. 3.—DIAGRAM SHOWING CIRCUITS OF SIGNAL.

Some interesting experiments in connection with the existence and nature of the microbes inhabiting the upper strata of the atmosphere, have been conducted by Dr. W. F. Hutchinson, of Cambridge, England, by means of a balloon. He took with him eight samples of glycerinated gelatine, which had been specially prepared. With these he secured specimens of the bacilli in the atmosphere above London, and these are now in course of cultivation and examination at his laboratory at Cambridge.

SOUTHERN PACIFIC NEW LINE ACROSS GREAT SALT LAKE.

BY A. W CLAPP.

There never has been in the history of railroad engineering such a radical change in the alignment of a road as that inaugurated by the Southern Pacific from its present route to that by which it will cross the Great Salt Lake on a timber trestle.

The present distance of the line from Ogden to Lucin is 145.5 miles. Much of this distance is made by the line running about 50 miles north before turning around the north end of the lake. Over this route are many sharp curves and heavy grades.

The new cut-off will run west from Ogden to the shores of the lake, crossing to Promontory Point on seven miles of trestle; then cross the peninsula for five miles and then across the main body of the lake to Strong's Knob on the west shore. The total length of this cutoff will be 104 miles, a saving of over 41.5 miles.

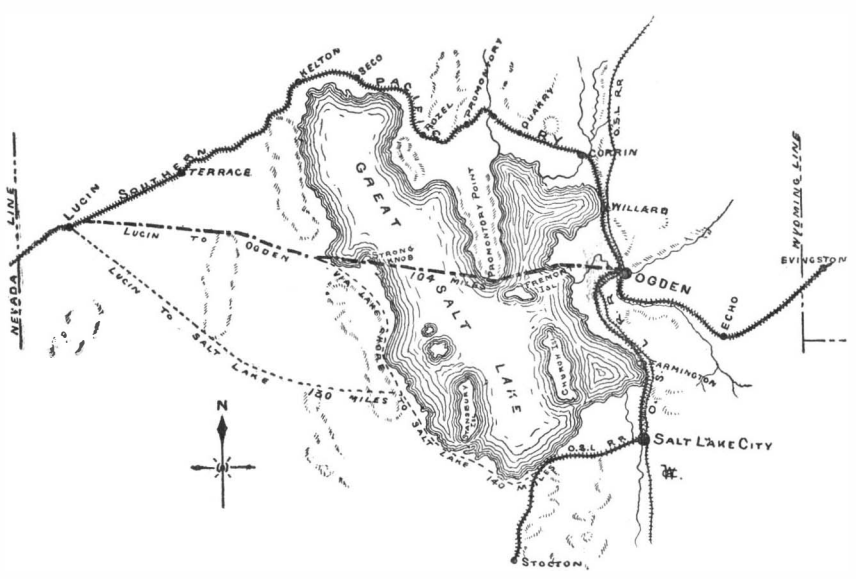
From the east shore over to the Promontory the lake is quite shallow, being not over eight feet deep. It is expected that this stretch will be filled in with earth and rock ballast, after the temporary bridge has been constructed; but the deeper portion across the main arm of the lake will be bridged. The deepest water, about 30 feet, is encountered on this stretch, which will be on a tangent. Curves will be few and very light over the entire distance from Ogden to Lucin. The fall from Ogden to the east shore of the lake is 101.7 feet, and the rise from Strong's Knob to Lucin is 512 feet in 58 miles, thus admitting of a very easy grade.

The most formidable task will be the building of the trestle across the main body of the lake. As is well known, the first material found at the bottom of the lake is a layer of very fine sand from six to thirty inches in depth. Then comes a hard stratum of soda formation of from a foot to 18 inches in thickness, and after that alternate strata of sand and blue clay for an indefinite depth.

The trestle will be built high enough to allow a rise in the waters of the lake. The low stage of water in the lake makes the present time a favorable one for the survey and construction of the new line. The experience at the Salt Lake bathing resort has been that the sand tends to accumulate around driven piles. If the same experience is had with the piling of the trestle, the result will be a rapid shallowing of water along the same, giving an increased security for the route as time progresses.

In addition to the great saving in distance, the construction of the line will bring the immense deposits of guano on the islands within easy reach of a market.

Piling has already been ordered from Texas, and arrangements for its reception made in the Ogden yards. Contracts have been let, and work, which has already started at the Ogden end, will be rapidly pushed. The enterprise will call for an expenditure of about $800,000 per year for the next three years.



THE GREAT TRESTLE BRIDGE NOW BEING BUILT ACROSS SALT LAKE BY WHICH THE SOUTHERN PACIFIC R.R. WILL SAVE 41½ MILES OF DISTANCE.

Balloon Projects for the Sahara.

One of the recent balloon projects advanced in France is that of crossing the Sahara, and M. Les Deburaux, a prominent aeronaut, has been giving considerable study to the question and thinks it quite practicable by his method of guide-rope, and that it would be possible to make the passage across the Sahara from Tunis to the Niger by utilizing the northeasterly winds which prevail in the region. The Count Castillon de Saint-Victor, who was one of the party on the last Mediterranean trip, is convinced of the practicability of the scheme, and wishes to put it into execution. However, the expense of such an undertaking would be considerable, and a large balloon sufficient to carry four or five aeronauts would necessitate an outlay of $60,000. For this reason the promoters of the enterprise wish to make an experiment on a small scale and use a balloon which is not mounted by an aeronaut, but is arranged on an automatic system. This experiment could be made for the comparatively small sum of $4,000. According to the project of M. Deburaux the balloon is provided with an automatic apparatus for keeping it in equilibrium and also with an automatic ballast-discharger, and these two devices would serve to replace the aeronaut. The equilibrium is to be assured by a heavy guide-rope made of steel cable and weighing 1,100 pounds for a balloon of 4,000 cubic yards. The automatic ballast-discharger is a water reservoir containing 5,300 pounds of water ballast and provided with a simple and solid arrangement by which if the balloon approaches within 150 feet of the ground the tank will discharge 150 pounds of ballast in half a minute. The balloon is to be provided also with an interior air-bag which will keep it always swelled out in shape in spite of the leakage of gas. It is estimated that under the most unfavorable conditions the balloon would remain in the air at least 12 days. There are ample data in regard to the prevailing winds in the region, and all the Sahara explorers are in accord that the north-northeast winds blow over the central Sahara in an almost constant manner from October to April, with invariable fine weather. These winds would propel the balloon provided with its guide-rope at a mean speed of 12 miles an hour, and thus it would cover 288 miles in 24 hours. If the balloon should become shipwrecked *en route* it would in any case have been seen by the nomads of the desert, and as its passage would be for them an extraordinary phenomenon the news would be quickly spread abroad and there would be no difficulty in forming an idea of the traject made by the balloon, and perhaps the wreck could be found, together with the registering instruments with which it would have been provided.

The Ventilation of London's Underground Railway.

Ever since the opening of her first underground railway, in 1863, London has been confronted with the serious problem of tunnel ventilation. All sorts of plans have been tried, but the air is still far from satisfactory, and is a menace to health. The directors of the Central London Railway are now taking expert advice on the matter. The subject has, however, already been thoroughly investigated by a Board of Trade committee which sat in 1897. After examining a large number of experts they came to the conclusion that the tunnel could be properly ventilated by the use of fans placed at intermediate points between the stations, but that the expense entailed would be great. According to the plan, shafts would have to be sunk midway between each two stations to act as outlets for the air, the stations and their approaches acting as inlets. In order to properly diffuse the impure air it would be necessary to carry the shafts as high as the neighboring buildings. The fans used would have to be large and open, so that they could be revolved slowly, and thus rapidly change the whole air in the tunnel without causing a strong draft. At the same time the disagreeable vibration caused by rapidly-moving machinery would be avoided, and the power expended would be reduced to a minimum. The fans proposed would change the air in the tunnel in about two and a half minutes, which is about the time it takes a train to pass between stations. Fresh air would thus be kept constantly flowing through each section of the tunnel at the rate of three miles an hour. This method was the cheapest of all proposed, the power of driving each fan by electric motors being conveniently available.

The Influence of Music Upon Animals.

Some very curious experiments have recently been carried out in the German Zoological Gardens in order to ascertain the actual influence of music upon animals. The instrument was the violin and Herr Baker was the performer. Of all the animals the puma was the most sensitive to the musical influence. His moods changed rapidly according to the nature of the melody, the animal frequently becoming very excited and nervous, "just like a Frenchman," as the report says.

Leopards were entirely unconcerned, but the lions appeared to be afraid, although their cubs wanted to dance when the music became livelier. The hyenas were very much terrified, but the monkeys were merely curious and interested. Wolves, on the other hand, were highly appreciative and seemed to beg for an *encore*.

The experiments are to be continued and with a variety of instruments, in order to distinguish between the mental states which are actually produced by the music and those which are merely the result of an unusual experience.

A WATER-TUBE LOCOMOTIVE BOILER.

As our readers are well aware, the SCIENTIFIC AMERICAN has been a frequent advocate of the adoption of the water-tube boiler for the locomotive. In the first place, quite apart from any considerations of superior economy and lighter weight for a given power, there is a demand for this type in locomotive service, due to the fact that with the present form of boiler we have about reached the maximum size that can be accommodated by the loading gage on our railroads. Such boilers as those in use on the latest express engines of the New York Central Railroad, with 3,500 square feet of heating surface, and on the latest freight engines of the Santa Fé Railroad, with 4,800 square feet, could not be enlarged in diameter without lifting the sandbox and steam dome so high that they would be in danger of striking bridges and other superstructures.

The water-tube boiler, however, not merely possesses greater steam-raising capacity for a given weight and size than the ordinary locomotive boiler, but when properly designed it is unquestionably more economical. The advocates of the standard locomotive boiler type would doubtless be prepared to dispute this, yet the latest evidence, gathered from actual trials under ordinary working conditions on an English railroad, establishes the superiority of the water-tube type. The locomotive which we illustrate on our front page is a particularly interesting machine, for the reason that its boiler, though it conforms in general appearance to the standard, is of the true water-tube type, as will be readily seen from a study of the details. It was designed by Mr. D. Drummond, the Locomotive Superintendent of the London and South-Western Railroad of England, who for some years now has been carrying on successful experiments in the use of water-tubes on a modified scale, placing them in the upper portion of the firebox. In his earlier boilers the water-tubes were confined to this part of the boiler, and one of our illustrations shows the doors on the side of the firebox, made heavy enough to withstand the boiler pressure, by which the nests of tubes are exposed for cleaning or repairs. The good results obtained with these firebox water-tubes led Mr. Drummond to carry his principle considerably further, and build a locomotive entirely on the water-tube principle. The firebox contains forty transverse horizontal tubes. The place of the usual horizontal fire tubes in the barrel is taken by a single large cylindrical flue, which is traversed by 215 cross water-tubes arranged diagonally, as shown in the illustration. In order to give the proper amount of staying to the upper corners of the front end of the firebox, fire tubes of the ordinary kind to the number of nine on each side are run in from firebox to front tube plate.

The engine here shown was built specially to test the new principle. It is a small affair compared with the modern full-powered locomotives of the railroad, its total heating surface being only 736 square feet. In reply to our inquiry, Mr. Drummond writes us that he now has in service on the South-Western Railroad a hundred engines whose boilers are fitted with cross water-tubes in the firebox, and he writes that up to the present time no complaints whatever have come in, and that during the last two years no repairs have had to be made. The engines so fitted are much more economical in coal than those not fitted with the cross tubes in the firebox, and the success has been such that all of the engines of the South-Western Company are now made with cross tubes.

The engine here shown has been running for over three months in competition with engines of the standard type, with flue tubes, giving a heating surface of 1,291 square feet, and the result shows that the little water-tube locomotive, with its small heating surface of 736 square feet, averages one pound of coal per mile less than the standard engines, although it is doing the same work.

We must confess that this strikes us as a very remarkable result. Where the disparity in heating surface is so great the efficiency of the smaller heating surface is, we imagine, to be attributed to the fact that the retardation of the hot gases on their way from the firebox to the smokebox is very much greater with the system of cross water-tubes than with the ordinary straight fire tubes, and consequently they give up much more of their heat and escape at a lower temperature to the smokestack.

The Chemical Value of the Human Body.

An ingenious chemist has made the claim that the average human being is worth about $18,300 from the chemical standpoint. His calculations are based on the fact that the human body contains three pounds and thirteen ounces of calcium; and calcium, just now, is worth $300 an ounce.

Correspondence.

A Market for Kerosene Engines.

To the Editor of the SCIENTIFIC AMERICAN:

The people of this country are boycotting all German manufacturers. They do not as yet import American goods, on account of high custom duties. One of the engine works here wishes to buy the right of manufacturing in this country an American kerosene engine, for small trade, of 1 to 8 horse power. They would either purchase the patent of such machine for this country, or they would, if preferred, go into a partnership with an American manufacturer to build such engine here on royalty.

Offers will be acceptable only for the best and latest improved kerosene engines.

Any offers can be addressed directly to me and I shall mediate between the parties on both sides, on account of language.

BATESLAW HORODYNSKI, Vice U. S. Consul.

Warsaw, Poland, March 15, 1902.

A Letter from India.

To the Editor of the SCIENTIFIC AMERICAN:

I am extremely obliged to you for your letter of November 23, 1901, and for the pretty calendar inclosed therein, and I must apologize to you for not having acknowledged them ere this. The calendar is a splendid work of art and has been admired by all to whom I showed it.

The SCIENTIFIC AMERICAN supplies in India the much-needed want of a really scientific journal, and it is needless for me to add that it is read with the greatest interest by me and my several friends. I don't think we will ever give up subscribing to this paper, replete as it is every week with fresh and latest intelligence of progress made in the world of science and art.

There are all sorts of things and latest works of art advertised in the advertising columns of the paper, but the difficulty for us Indians is how to get them. I tried value payable parcel for something I wanted two years ago and remitted the money, but it was after eighteen months or more and a great deal of correspondence that I succeeded in obtaining it.

I know the distance between us is nearly 9,000 miles, but I am sure the fertile brain of Americans can devise means by which the obtainment of what we want, whether in the shape of machinery, books or some such things, might be assured, the money being paid to a representative or representatives in Bombay or any other station in India. There are several American missionaries doing a lot of excellent work among the Indians, and some of them might establish agencies with the United States. We cannot but admire the self-imposed but noble task of the missionaries. They are working among the lowest classes and have succeeded in elevating them both morally and socially.

DINSHAW D. KHAMBETTA.

Iubilu Cottage, Poona, India, February 22, 1902.

Musical Flames.

To the Editor of the SCIENTIFIC AMERICAN:

I have read Tyndall's and other explanations and theories as to the effect of certain sounds on gas jets, but the said explanations do not appear to cover a case that we have here in the office of this estate. For testing purposes we have five attachments on one arm, the gas for all of which previously passes through a gas gage. One of the five attachments is a Kern No. 0 burner, which the manufacturer grades as burning 8 to 10 feet of gas per hour; and when lighted gives say 15 candle power light; but if I jingle or rattle my bunch of office keys, will increase the light to as much as double, *so long as I keep on rattling the keys*, and which may be done as much as 15 or 20 feet away and behind a screen; but the farther we are away from the gas jet the less effect the rattling of the keys has. There are other noises which seem to have about the same effect, such as rattling stiffish writing paper. Sometimes the increase in light is only about 25 or more per cent, and there never is any apparent tendency of the jet to sing or whistle, *simply an increase of light*. I cannot say whether any more gas is being used when keys are being rattled or not, but the whole apparatus is here and open to inspection by anyone interested in the subject.

It appears to me that we do not yet thoroughly understand the action of sound waves on gas jets; and without assuming to know anything about it myself, I believe that vibrations other than those of light have an effect on light vibrations. The reported invention of a form of "arc light" which will give off musical sounds performed considerable distances away may possibly be based on the same principles which appear to affect our Kern burner.

The increase in light when keys are rattled is certainly *not* caused by increased air circulation, as I carefully tried the experiment of waving fans and creating more or less air circulation, but without any effect whatever on the gas jet I mention.

WILLIAM LITCHFIELD.

Winnipeg, Man., March 13, 1902.

Automobile News.

Two Frenchmen have found that if acetylene be dissolved in acetone, the danger of explosion is very considerably decreased. Since 1896, Messrs. Claude and Hesse have been trying to dissolve acetylene in some liquid in order to obtain an accumulation of the gas in portable receivers at a pressure considerably below that required for liquefaction. As a result of many experiments acetone was the liquid finally selected as the solvent.

An electric delivery wagon that has been in use for about a year now, is one of the important adjuncts to the new Congressional Library at Washington. By its use the Library is able to make two deliveries daily at any point within reasonable limits. The present vehicle, motorman, and four attendants are kept extremely busy every week day, and it would not be surprising if, before long, a second delivery wagon were found necessary.

The Cocks Automobile Speed bill passed the New York Senate on March 6. The bill provides that a chauffeur who drives his vehicle faster than 8 miles an hour within a city or village where local ordinances do not otherwise provide, and faster than 20 miles an hour outside a city or village limit, or faster than 4 miles, and in which it is anticipated, automoblists first offense not exceeding $50, and for the second offense not exceeding $50, or by imprisonment for a term of six months or both.

Some ninety cabs and broughams and thirty delivery wagons belonging to the now defunct New England Electric Vehicle Transportation Co., of Boston, were purchased by New York gentlemen who, it is said, intend equipping them with gasoline motors in place of electric, and then putting them into service again. Should this feat actually be accomplished, it will be interesting to note how the transformed vehicles compare with their former selves in expense of operation and up-keep, if the residents of asthetic Boston can stand the turning of their city into a miniature Paris —from an automobile point of view—long enough for results of this nature to be noted.

The Paris-Vienna race is to be the great automobile event of the season, and the Automobile Club of France and the Austrian Club are now busily engaged in arranging the details of the race and receiving the applications. As in the Paris-Berlin, there will be two distinct classes, one for the regular speed race and the other a touring excursion in which the main points to be noted are the endurance and general good performance of the machines. The main regulations for both races have lately been issued. For the speed race, the automobiles will start so as to reach Vienna on the 29th of June. The total route, of which the details will be given later, will be divided into three or four stages. The automobiles will be arranged in five classes: motor bicycles, moto-cycles, voiturettes, light and heavy machines. At each stage will be placed a commission which will note the arrivals and departures. Some parts of the route, especially across cities and towns, will be "neutralized," that is will not be counted in the race proper, and the automobiles will be given a certain time to cross these places. In order to indicate the route to be followed a series of signals are to be placed at convenient intervals; these consist of an orange triangle with the point turned in the proper direction. A yellow flag indicates an obligatory stop, blue a slow-up for danger or in the case of crowded districts which are not neutralized; these latter are placed 300 feet in advance. A white-and-blue flag means to go on again at full speed. After the race an exposition is to be held at Vienna, and all the machines which have made the run are to be on exhibition. The tourists' race is to be no less interesting. In this case the vehicle must be of a standard type such as is built for sale, and must seat the passengers comfortably. The power of the motor is to be declared; it must be in proportion to the class and weight of the vehicle. The machines are to carry in front a large sign bearing the inscription "Paris-Vienna," with the insignia of the clubs and the regulation numbers. The excursion is to take place from the 17th to the 28th of June. The drivers will be furnished with a detailed guide indicating the route. Special attention is to be given this time to the proper conduct of the automobiles along the route and especially in the crowded districts. The drivers are obliged to go at slow speed through towns and villages, not to frighten animals, and in general to take various precautions to avoid accidents. At the controlling stations the arrival and departure of each vehicle will be officially registered. A diploma and a souvenir medal will be given to the owners of the successful machines, and there will probably be especial prizes given by associations or individuals for the best all-around vehicles. The government of Bosnia-Herzegovina has officially invited the tourists to visit that country after their arrival at Vienna. The invitation has been accepted by the clubs, and this excursion will no doubt be one of the interesting features of the tour.

Engineering Notes.

A process has been introduced in France for making briquettes of garbage. The refuse of the abattoirs, fish markets, etc., straw, paper and the like is cut fine and mixed with tar and naphtha. The mass after being kneaded is dried and pressed into briquettes, which it is claimed will burn brightly, giving off a slight odor of gas, and engender heat slowly.

News come from Germany that American coal is not looked upon with favor by housekeepers and consumers in general. The reason is to be found not in the poor quality of the coal, but in the lack of knowledge of the Germans. The coal is so hard, and the stoves so poorly constructed, that the condemnation is not to be wondered at. Despite these obstacles, Germany must now depend largely upon the United States for her supply of anthracite. Great Britain scarcely produces enough for her own consumption.

Very large installations of a water purifying and softening system, known as the Desrumaux, are now being made on the Continent and in England, which system is said to involve the use of lime only. A railway installation aggregates one million gallons daily, or enough for a good-sized city, and is to be used for steam and household purposes as well. Water from rivers, canals and commercial waterways of all kinds is rendered bright, clear and potable, and is so entirely free from foreign matter in suspension or in solution that it is found to be excellent for deep-water shipping.

The longest voyage on record under liquid fuel was recently completed by the steamship "Murex." The course lay from Singapore to London, via Cape Town, and covered a distance of 11,830 miles. The total consumption of liquid fuel for all purposes was from seventeen to eighteen and one-half tons per day. Had coal been used instead the consumption would have been from twenty-four to twenty-five tons of Welsh, or with Japanese from thirty to thirty-two tons daily. Aside from actual saving in cost, one must consider the economy in labor and the increase in the available cargo-carrying capacity.

The writer of the series of articles on American engineering competition which appeared in the London Times in 1900, and which attracted world-wide attention, has written for that paper an account of the British Westinghouse Company's Works at Trafford Park, Manchester. As might be expected, the writer considers the erection of these works a veritable boon for British industry. The new works, in his opinion, will do much to redeem the lost glory of England in the field of electrical engineering. The writer in the Times points out that the confidence reposed by American business men in the British engineering industry is shown by the fact that they are willing to wait until six per cent profit has been realized on the manufacturing operations before they receive any returns. At present only the buildings have been completed; but the installation of machinery is progressing rapidly.

Some eighteen months ago the British government appointed a special committee to investigate the explosive qualities of cordite for military and naval purposes. Cordite has been the British service explosive since 1889. The committee was formed in response to the numerous complaints that had been received from South Africa regarding the extensive corrosion of the barrels of the guns, and the uncertainty of the explosive's detonation. The committee had for its chairman the distinguished chemist Lord Rayleigh, and among its members were Sir Andrew Nobel, of the Armstrong works; Sir William Crookes, and Sir Roberts-Austen, a great authority on steel. The committee made an exhaustive inquiry as to the corrosive effect of cordite on guns, the immense cost entailed by repairs, and the difficulty of preserving the explosive in varying climates. The cordite used in the English army and navy consists largely of nitroglycerine, although its exact composition is a secret maintained by the government. The results of the exhaustive investigations have been the emphatic condemnation of cordite for service purposes. The committee, however, recommended a new powerful explosive, which is to be adopted, and the most salient characteristics of which are that it is immune from the disadvantages incidental to cordite. The exact nature of this new explosive is maintained a secret, and so highly is it valued that, contrary to usual custom, the committee's report upon cordite and the new explosive will never be published or issued in any form whatever. The government is also experimenting with a new smokeless and flameless explosive. The attainment of the latter will be an invaluable discovery, since it will then be impossible to locate the whereabouts of the gun firing such an explosive. This end can be achieved by obtaining such an excess of oxygen as will completely convert the carbon, not merely into carbon-monoxide, but into carbon-dioxide, at once. The committee which has condemned cordite is to be constituted into a permanent body for the purposce of investigating the question of explosives.

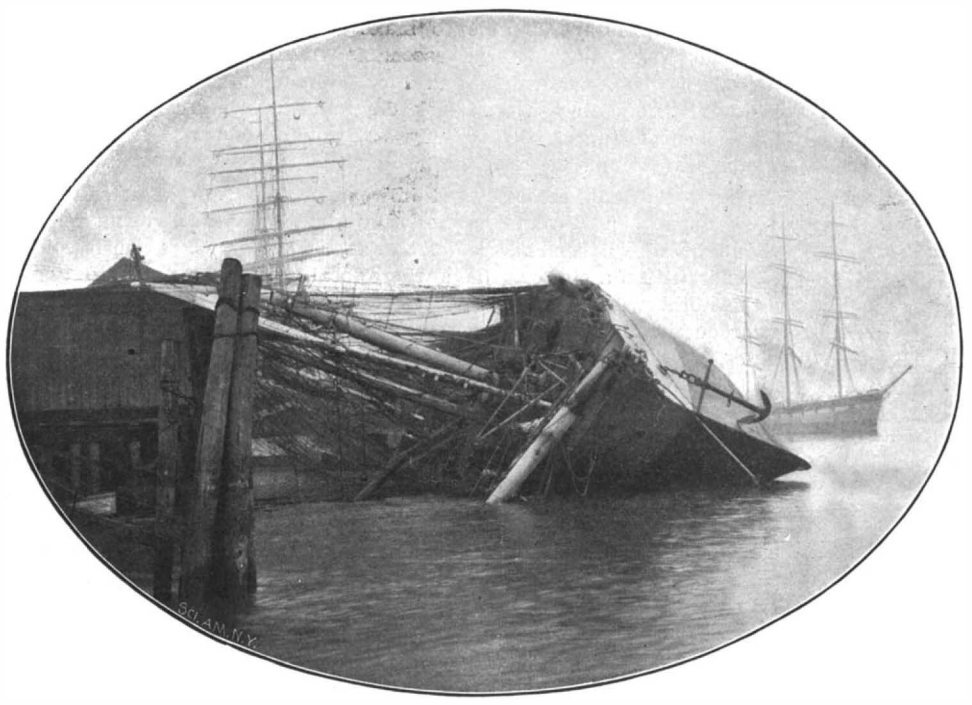
CAPSIZING OF THE FRENCH BARK "ASIE"

BY L. C. SCHAFER.

It is not an uncommon accident in the unloading of modern cargo vessels, whether steam or sailing, for the margin of stability to be brought down to the vanishing point, with the result that the ship capsizes. The best modern practice seeks to construct all vessels with such a metacentric height that the ship may be unloaded until she is absolutely empty without any danger of her capsizing. As a matter of fact, however, a large proportion of the vessels afloat require water ballast or solid ballast at all times, and, in unloading, care has to be taken not to render the vessel too light.

The French bark "Asie," which is herewith pictured in a pretty badly wrecked condition, was supposed to have been constructed to stand without ballast; but on the last day of the year 1901, while she was moored at her dock at Portland, Ore., she started careening, and before anything could be done to save her, turned over on her broadside and assumed the position shown in the photograph. At the time of the disaster there were thirty-seven men in the hold, unloading the sand ballast. The crew of twenty-two men and three subordinate officers gained the dock uninjured. Of the eleven stevedores employed on the boat, ten escaped without injury, and one was caught under the sliding ballast.

As the bark capsized the fore, main and mizzen masts struck the dock alongside of which she was moored, and were each broken in several places. The foremast was broken in three different places, the mainmast and mizzenmast in two places. All the yards were either torn loose or smashed, and only the jigger mast escaped. The bowsprit was also unshipped and thrown over to starboard, in the position shown in our engraving. The "Asie," is estimated to have sustained about $30,000 damage. She is a craft of 2,059 tons register, and is a sister ship to the "Europe." In righting the vessel the hull was secured to the dock, and the masts and gear were cut away, when the vessel immediately righted. It will take about four months to put the vessel in shape for the homeward voyage.



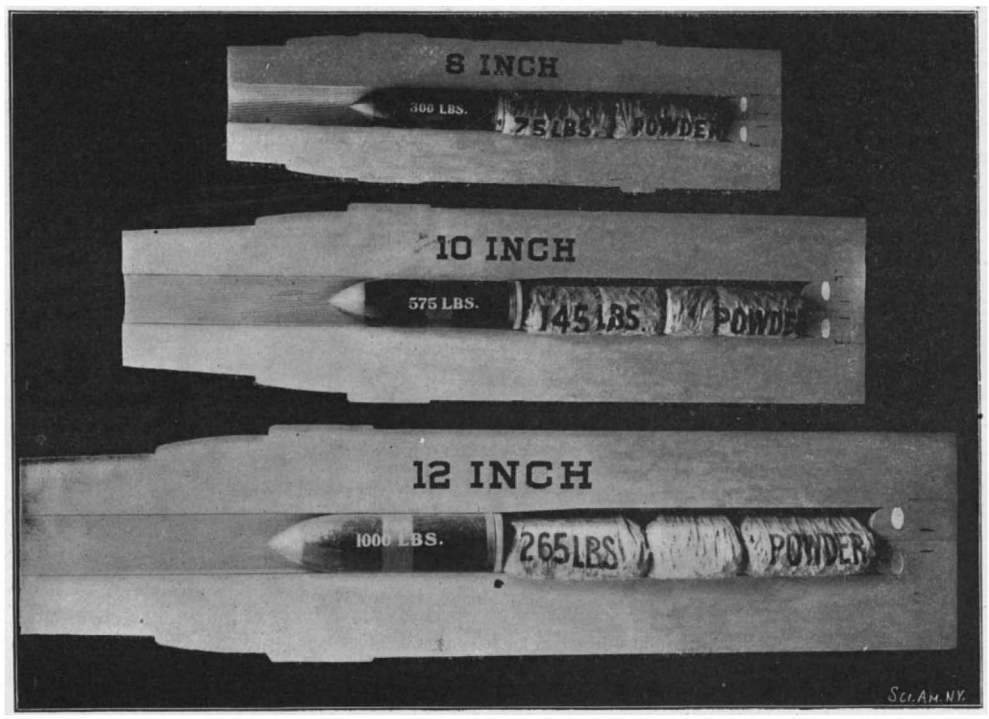
THE CAPSIZED BARK "ASIE."

AN OBJECT LESSON IN HEAVY ORDNANCE.

At the very completely-equipped Armory of the Thirteenth Regiment in Brooklyn, in addition to three full-sized models (and working models at that) of heavy seacoast artillery, there is a stand of three large, full-sized model sections of the principal seacoast guns, namely, 8-inch, 10-inch and 12-inch. The models are built of wood, and they are carefully lined and painted, so as to represent the appearance of sections cut from actual built-up steel guns. They represent the breech half of the gun, from a few feet forward of the trunnion ring to the breech. They are represented with the breech-block closed and locked. The breech-plug is an exact model, and shows the mushroom head and the obturating material which serves, under the pressure of the powder, to completely seal the breech and prevent the rearward escape of gases. The powder chamber of each section is filled with bags, of the exact size and appearance of the actual powder bags, the sticks of smokeless powder being here replaced by short lengths of round wood, ordinary broomsticks, in the case of the larger guns, being cut up into lengths to serve the purpose.

The 8-inch gun fires a 300-pound shell with a charge of 75 pounds of smokeless powder, which, for the convenience of handling, is put up in two bags. The 10-inch gun fires a 575-pound shell with 145 pounds of powder, which is also put up in two bags. The shell for the 12-inch gun weighs 1,000 pounds, and the charge of 265 pounds of powder is put up in three separate bags. It will be noticed that the powder chamber is larger in diameter than the bore of the gun. Thus, the 8-inch gun has a diameter of 9.5 inches in the powder chamber, the 10-inch gun has a diameter of 11.8 inches, while the powder chamber of the 12-inch gun is 2½ inches larger in diameter than the bore.

In loading the gun the breech-block is unscrewed and swung clear of the body; the shell is then introduced into the powder chamber and thrust sharply forward until it brings up with its rotating band of copper jamming tightly into the commencement of the rifling; that is, into the spiral grooves which extend through the bore of the gun and serve to give a twist to the projectile. The band is of somewhat larger diameter than the lands of the gun, and when the explosion of the powder takes place, the metal of the copper band enters the grooves, fills them entirely, and thus serves to prevent the escape of gases past the base of the shell. The rifling band consequently acts the double part of a gas check and a means of imparting the rotation. At the instant of firing the initial pressure in the power chamber rises to 16 or 17 tons per square inch. As the shell moves down the bore, the powder pressure gradually falls; but it does not fall so rapidly as it did in the days of the old black powder, for the reason that the smokeless powder is what is known as "slow-burning," and keeps on giving off fresh gases to fill the increasing space behind the shell, thereby maintaining a higher average pressure on the base of the projectile and securing a higher velocity of the shell at the muzzle.



AN OBJECT LESSON IN HEAVY ORDNANCE.
Models of heavy coast-defense guns at the 13th Regiment Armory, Brooklyn.

Firing Large Power Plants.

There are four power plants in New York city today whose engine capacity when completed will aggregate 400,000 horse power. These are unquestionably the largest central stations in the world, and they contain the latest improvements in machinery and methods for generating and distributing power by electricity. Not the least interesting feature in these stations is the elaborate plant which has been installed for firing the boilers, bringing the coal to the furnaces and removing the ashes. The question suggests many interesting conditions. Imagine the Manhattan plant, for instance, receiving its coal in trucks, run into the station in the old way, and dumped in front of the fire grates, and the ashes hauled away in railway trucks or push carts. That is the way this work was formerly done. The boiler room would have to be three or four times as large as at present, and a stoker brigade of several hundred men would be required for hand-firing; besides the labor and the dirt and confusion arising from loading the coal and ashes would be an important factor. By coal-handling and conveying machinery and mechanical stokers in these large plants, however, the problem is simplified; the work is done by a comparatively small force, the boiler room is entirely free from coal, ashes, dirt and smoke, better results are obtained, more perfect combustion is secured, and the smoke which is due to improper firing is entirely eliminated.

In the large power houses mentioned, the mechanical equipments for handling fuel, feeding the fires, and removing the ashes have been developed to the highest point of efficiency known to modern engineering. For the Manhattan plant, now in course of construction, the coal is delivered in barges at the dock, and unloaded into bunkers above the boilers at the rate of 150 tons per hour, by means of a tower equipment with a 1½-ton shovel, crushers and weighing hoppers, and a bucket conveyor. Perhaps the most interesting feature of the problem is the provision that has been made for feeding the fires. Coal is brought from the great storage bunker under the roof, which has a capacity of 15,000 tons, to hoppers at the front of the boilers by means of chutes, and is then fed at a previously determined rate to the inclined grates by means of automatic machinery known as the Roney mechanical stoker. It was estimated by the engineers for the Manhattan Company that at least 270 men would be required to fire their boilers by hand, whereas with the stokers a saving in labor alone can be effected of over $400 per day. Another important advantage gained by adoption of this stoker is the fact that it will permit the use of hard or soft coal, either separately or mixed. For this no alteration is required in the arrangement or construction of the stokers, merely a different adjustment of the feed and grate-actuating mechanism. The supply of coal fed to the furnace is regulated by the feed wheel, and the motion of the grate bars is adjusted by the position of the lock nuts, and these adjustments are easily made by any fireman. Practically the same form of equipment has been adopted for all the large power stations that have been undertaken in New York of late years, and one of the greatest advantages, aside from economy and efficiency, is that enjoyed by the public in the elimination of the smoke nuisance. This is brought about by the fact that mechanical stoking, by providing first a sufficient air supply for the combustion of the volatile gases, secondly a constant high temperature, and thirdly a uniform supply of fuel, regulated as required, presents conditions closely resembling those in a large Argand burner. This is true both of the ease with which the fuel and air supply are regulated, and in the smokeless combustion of the hydrocarbons of the coal.

It is proposed to introduce these devices at the St. Louis World's Fair, and this will work an important advancement in standard steam plant practice over that of the Chicago Fair—probably one of the most important power station developments in the ten years intervening. It will be remembered that the Chicago World's Fair plant depended upon oil fuel, as the objections to the dirt and smoke and ashes from a power plant using coal were considered unsurmountable.

Gift to Harvard.

From a friend of Prof. Pickering Harvard College has received a gift of $20,000 for the benefit of the college observatory. The very urgent need of the observatory will be at once relieved by this gift. The building provided nine years ago for astronomical photographs has become inadequate. Prof. Pickering intends to expend about half of the fund in extending the present building, in order to provide for the storing of the collection. The photographs furnish a history of the entire stellar universe for the last twelve years, and cannot be duplicated in any other observatory. They are of immense value in studying the past history of any part of the sky. The remainder of the fund will be expended as the needs of the observatory may demand.

INDICATING AND RECORDING THE TIDES.

BY DAY ALLEN WILLEY.

The system employed for predicting, recording and indicating the fluctuations of the tide by the United States government is acknowledged by mariners to be more thoroughly developed and more accurate than any adopted by other nations. It is the result of experiments and investigations made by the Coast and Geodetic Survey, and consists of three different kinds of mechanism, the tide indicator, the tide recorder and the tide predicting machine, the last to be described in another article. The indicators are divided into two classes—one being in use at stations directly on the harbor, and the other installed at inland points which may be some distance from the locality where the ebb and flow of the water is being noted. The inland indicator, as it may be termed, is connected with the seaboard or harbor indicator by electric wires. For example, the apparatus at the Maritime Exchange in Philadelphia is a mile distant from the Delaware River, whose changes is records; but such is the system employed that these changes could be noted in Chicago or across the continent as accurately.

The harbor indicator appears as a large semicircle painted white, and faces up the stream. The inner edge of the semicircle is divided into spaces by heavy black lines representing feet and half feet. The longer of these division lines are numbered by figures in black. A pointer, actuated by the rise and fall of the tide, turning about the center of the circle, sweeps along the inner edge of the graduations and indicates, at any moment, the number of feet of water above or below the plane of reference (mean low water) to which soundings on the chart are reduced. The minus sign, shown near the left edge of the indicator, indicates the number of feet below the plane of reference. An arrowhead, placed in the center of the disk, is made to point up while the tide is rising and down while it is falling. A glance at the indicator will enable the navigator to tell the height of the tide, whether above or below mean low water, and whether it be rising or falling. The division lines, figures, pointer, and arrowhead can readily be seen at the distance of a mile with the aid of an ordinary marine glass.

The electrical tide indicator having an inland connection consists of two parts—the apparatus shown

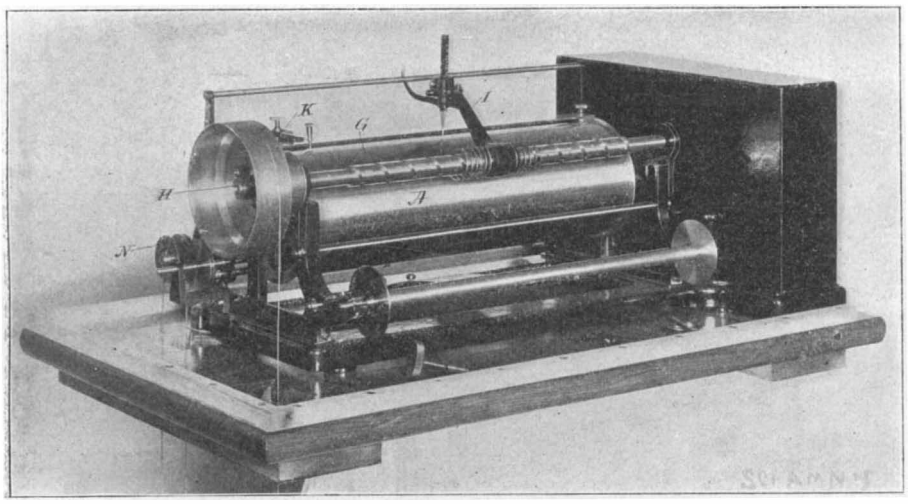


Fig. 1.—Rear View of Self-Registering Tide Gage.

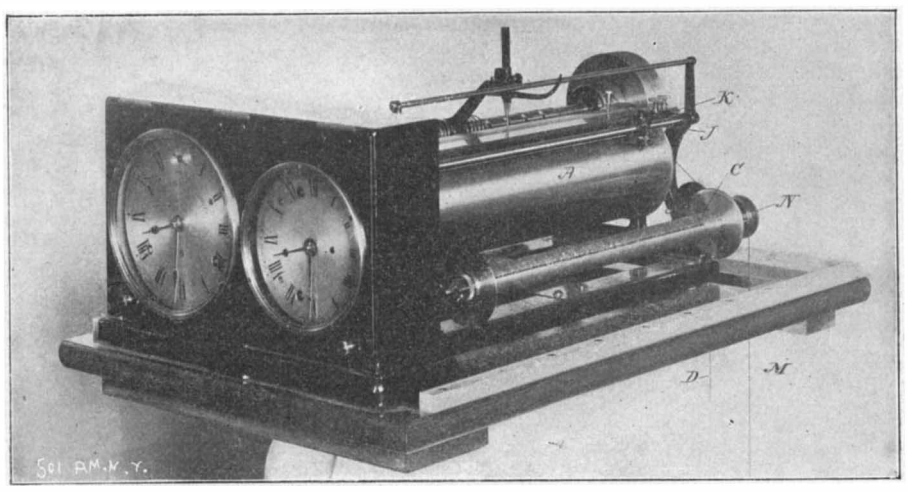


Fig. 2.—Front View of Tide Gage.

Fig. 3.—Tide Indicator at Fort Hamilton, N. Y.

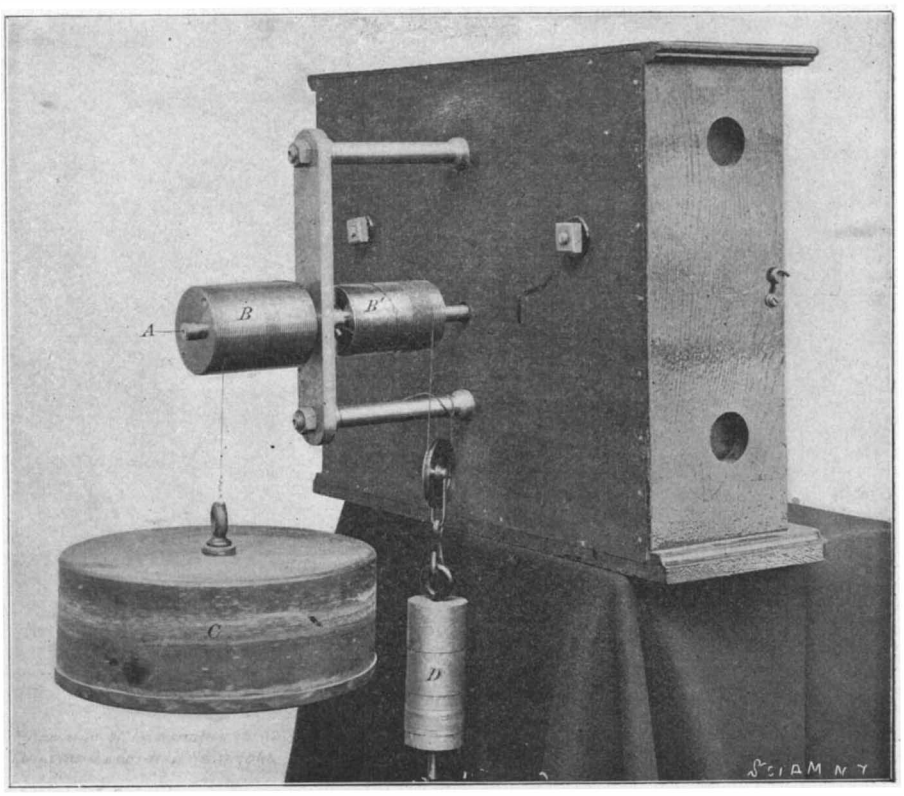


Fig. 4.—Rear View of Transmitter, Showing Float and Counterpoise Weight.

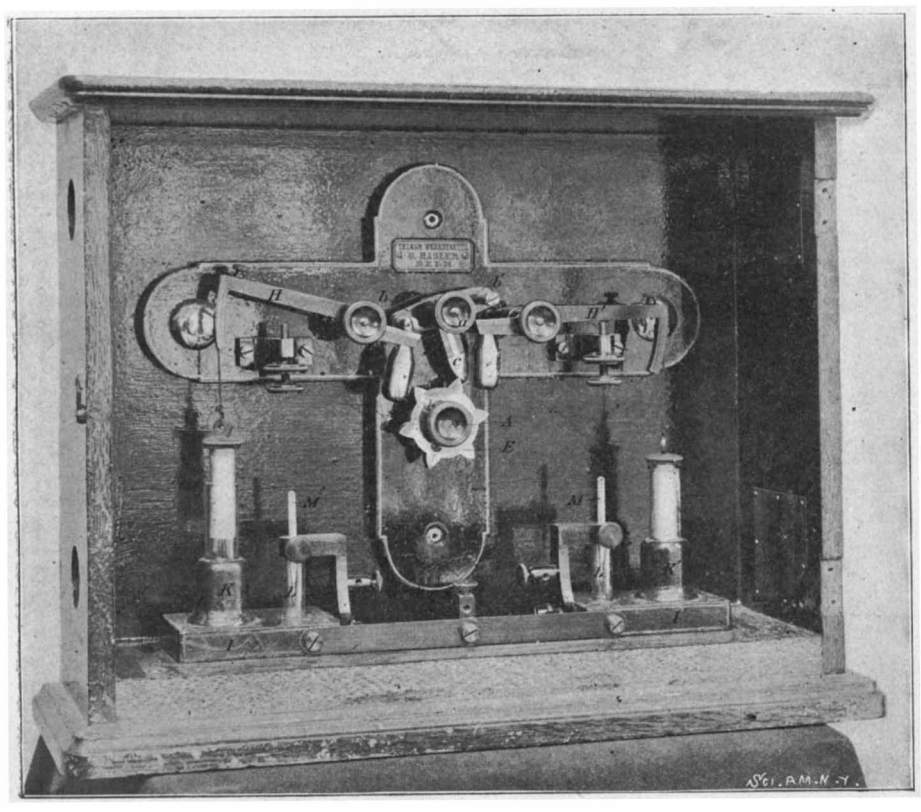


Fig. 5.—Interior of Transmitter.

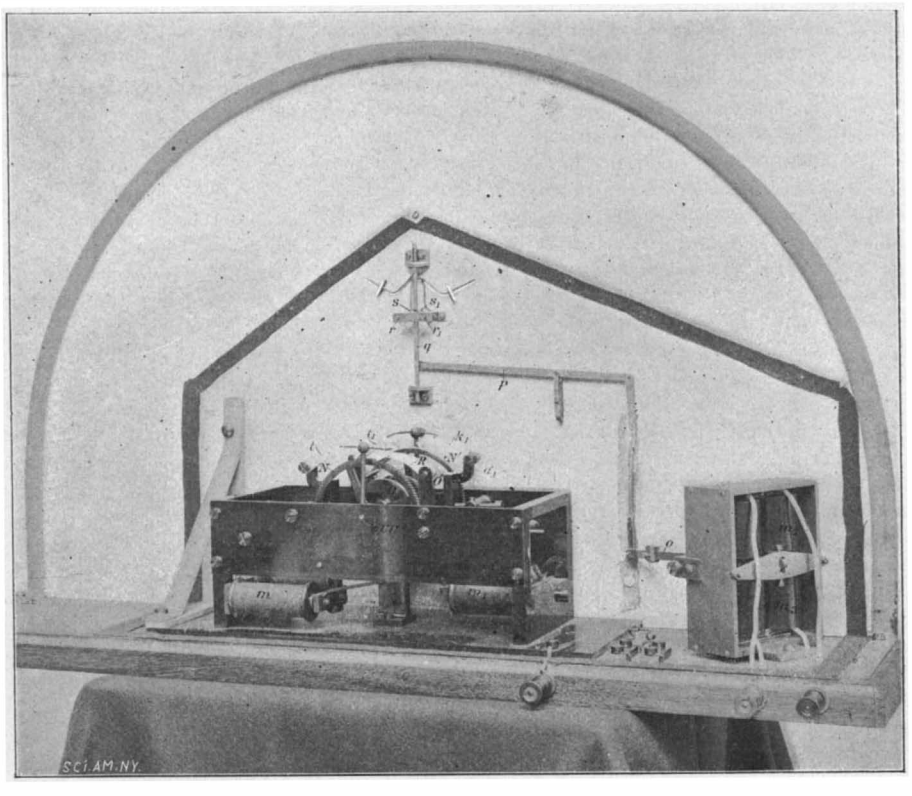


Fig. 6.—Receiving Instrument.

INDICATING AND RECORDING THE TIDES.

in Figs. 4 and 5, whereby the rise and fall of the water level is utilized to complete electrical circuits, which, in the second part (Fig. 6), through the intervention of electric magnets, communicate the motion to the indicator arm and device, by which the required information concerning the height and character of the tide is displayed to the public.

An arbor, *A*, behind the apparatus case, carries two brass drums, *B* and *B*¹. From *B* the float, *C*, is suspended, and from *B*¹ the counterpoise, *D*. The same arbor in the interior of the case carries the six-toothed wheel, *E*. Above the ratchet wheel is placed a three-armed lever, movable about the center, *a;* the two horizontal arms carry the pins, *b b ;* the vertical arm, *c*, engages the teeth of the ratchet wheel. The pins, *b b*, rest on the short arms of the levers, *H H′*. Resting on the bottom of the apparatus case are two cast-iron reservoirs, *I I′*, containing mercury, which are equipped with the tubes, *K K′* and *L L′*. In the larger tubes, *K K′*, two cylinders plunge, which are suspended from the outer ends of the arms of the levers, *H H′;* from the smaller tubes protrude the ends of the contact ends, *M M′*.

If the level of the water is lowered, the float, descending, causes the wheel, *E*, to turn to the right, the lever, *H*, raising the cylinder slowly until the arm, *c*, trips, when the cylinder falls, compressing the air in the large tube, *K*, raising the surface of the mercury in the tube, *L*, and producing a brief contact with the rod, *M*, thereby completing for a short time the electric circuit which brings the second apparatus into action. If the water level rises, the counterpoise, *D*, makes the wheel, *E*, turn to the left, and the mechanism on the right of Fig. 5, operating in a similar manner through a second circuit and set of electro-magnets, produces opposite indications on the dial.

The mechanism on the inland apparatus is shown by Figs. 3, 4 and 5. On an arbor, *U U* (Fig. 6), which carries the indicator arm, two pairs of wheels, *N O* and *N′ O′*, turn. Each pair is riveted on a common barrel. A rod, fixed in the middle of the arbor, *U U*, carries at one end a wheel, *R*, which engages the wheels, *N N′*, and at the other end a counterpoise. On the completion of the circuit in the apparatus at the tidal station, if the current of the battery passes through the electro-magnet, *m*¹, the latter attracts the armature, *a*¹. With the interruption of the current, a coil spring draws back the armature lever and the pawl, *k*¹, makes the wheel, *N*¹, advance one tooth. If the current passes through the electro-magnet, *m*, it is the wheel, *N*, which turns one tooth. The wheels, *N* and *N′*, are equipped with safety pawls, *t t′*, which permit of revolution only in one direction. When the wheel, *N′*, advances one tooth, the wheel, *R*, and the arbor, *U U*, with the indicator arm, *T*, turn in the same direction, while the wheels, *N* and *O*, are held in repose by the pawl, *t*. If the current passes through the electro-magnet, *m*, the wheel, *N*, turns backward one tooth and the indicator arm a space indicating a change of water level of one-tenth of a foot, while the wheels, *N′ O′*, remain unmoved. The direction of the arrow in the center of the dial shows whether the water level is rising or falling. This indication is secured by the use of two electro-magnets in series with *m m′* and a system of levers which control the position of the vanes which make the head of the arrow.

The tide gage or recorder is the design of Mr. A. Stierle, of the Engineer Corps. With an eight-day marine clock is connected, by a clutch, a light brass drum or cylinder, *A*, around which the recording sheets are laid, or over which the continuous paper passes, as one or the other respectively is used. This cylinder revolves twice in twenty-four hours, or only once, if so ordered, and is provided upon its surface with two rows of needle points, each row (of twelve points) being near one end of the cylinder, which puncture the paper and thus mark the time abscissas, either of two or four hours' duration. The cylinder can be lifted out of the frame after the clutch connecting it with the clock has been moved back.

The variations of the water level are transmitted directly by a copper float at the end of a fine wire, *E*, fastened to the periphery of a grooved float wheel, *F*. This wheel is exactly one foot in circumference, and has a projecting double flange in which are three cycloidal notches that extend to the bottom of the grooved rim. The rectilinear distance between these notches is four inches, and corresponds with the distance between small cross bars riveted upon the float band, *E*. The wheel, *F*, fits loosely upon the end of the screw, *G*, made of phosphor-bronze, but can be jammed with the nut, *H*. The screw, *G*, itself sets loosely between the framework, and together with the wheel, *F*, revolves as the float rises or falls, and thereby causes the pencil holder, *I*, which with its threaded core embraces the screw, to move right or left at the rate of one inch for every foot the float ascends or descends with the rise or fall of the water level.

On the rear of the frame a graduated rod, *J*, is placed, upon which is clamped the pencil holder, *K*, for the so-called stationary pencil. This pencil traces upon the recording sheet any assumed or established reference or base lines, usually the zero of a tide staff, from which the ordinates of a curve representing the water level can be readily measured. The copper float rises and falls with the water level in a square box, the interior clear area of which is about 1½ inches larger in width than the diameter of the float, its length being such as to reach about a foot below the lowest known water level of the locality and about six inches above the floor of the house in which the gage is set. The box is closed on the lower end, a small opening not over one-half inch in area being left in the center. One of the interior corners of the box is divided from the rest by a thin strip of wood extending the full length of the box, forming thus a separate compartment, in which the counterweight attached to the band, *D*, moves up and down.

The paper moves in the same direction as the hands of the driving clock and is drawn along, as it were, by the needle points upon the cylinder, *A*. This movement is materially assisted, but not accelerated, by a light counterweight at the end of the cord, *M*, which is suspended from a sheave or pulley, *N*, fitted upon the axle of the wooden roller, *C*. The cord is fastened with one end to the hub of the sheave, *N*, and is coiled or wound upon the latter in such a manner that it must unwind as the paper rolls upon the roller, *C*. The weight, *M*, causes a slight tension in the paper between the roller and the cylinder, *A*, and thereby assists in laying the paper evenly and smoothly upon the roller, *C*.

An attachment designed by Mr. F. M. Little is used for more accurately keeping and marking the time. This "hour-break" attachment, as it is called, consists of an additional and independent clock. On the back of the clock and attached to its minute shaft is an arm which at the end or beginning of each hour trips the trigger projecting from the break mechanism. This permits the crank, working in the slotted arm, to make one revolution. This slotted arm is fastened to the end of the lower rod, which is the axis of the frame. Over the upper rod the hook from the pencil carrier hangs, but not in contact, and the pencil holder is pivoted in the pencil carrier so that the pencil can be rocked. The pencil is held in its normal position by a small spiral spring, one end being attached to the pencil holder and the other to the pencil carrier. At the end of every hour the time clock releases the trigger, and thus the break mechanism rocks the frame over which the pencil-holder hook hangs, causing the pencil to move back and forth, thereby recording the hour exactly, regardless of what the rate or time of the driving clock may be.

Automobile Racing.

Racing has proved itself to be of inestimable benefit to the development of the automobile industry. At various stages and in different ways the racing chauffeur has been able to show the maker exactly what a certain construction will, and will not, stand under a strain of varying speeds. Sometimes the scientifically deduced theories of the maker would work out in good shape, and sometimes they would not work at all.

The chauffeur, ever ready to risk his neck on the new design, would try out with reckless zeal experimental vehicles which ordinary riders would not dare to push to full speed. Mishaps occurred, of course, but they only seemed to sharpen his appetite for testing new machines and identifying himself with the latest type.

The debt owed by maker and tourist to the racing chauffeur is similar in proportion to the credit due bicycle racing men for bringing the bicycle to its present marvelous basis of mechanical perfection.

No speed performance in which man ever partook compares with that of the automobile. It is much more fascinating than railroad locomotive speeding, and, as far as road racing is concerned, useful in calling public attention to the scandalous state of our roads and highways.

In order to give a correct idea of what has been accomplished in this country in automobile racing of various kinds we append the following tables, which present the carefully-revised authentic times of accepted road, track and straightaway automobile records. Many of them are world records.

TRACK RECORDS.

Gasoline Vehicles.

Best Mile Performances.

1:06 2-5—Winton, Detroit, October 24, 1901.
1:06 4-5—Fournier, Yonkers, October 10, 1901.
1:12—Keene, Yonkers, November 1, 1901.
1:13 2-5—Bostwick, Yonkers, October 10, 1901.
1:16¾—Vanderbilt, Providence, October 9, 1901.

From 1 to 24 Miles.

1 mile, 1:06 4-5—Winton, Detroit, October 24, 1901; 2 miles, 2:13 4-5; 3 miles, 3:20 1-5; 4 miles, 4:27 1-5; 5 miles, 5:33 4-5; 6 miles, 6:40 4-5; 7 miles, 7:47 1-5; 8 miles, 8:54 3-5; 9 miles, 10:01 2-5; 10 miles, 11:09.

11 miles, 14:02 2-5—Bostwick, Yonkers, October 8, 1901; 12 miles, 15:21; 13 miles, 16:38 4-5.

14 miles, 17:55 3-5—Fournier, Fort Erie, September 26, 1901; 15 miles, 19:10 4-5; 16 miles, 20:24 4-5; 17 miles, 21:40 4-5; 18 miles, 22:56 4-5; 19 miles, 24:12 2-5; 20 miles, 25:25 2-5; 21 miles, 26:42; 22 miles, 27:57; 23 miles, 29:12; 24 miles, 30:28 4-5; 25 miles, 31:44 1-5.

50 miles, 1:17:50—Winton, Chicago, September, 1900.

Steam Vehicles.

1 mile, 1:22 1-5—H. L. Hibbard, Joliet, Ill., October 19, 1901.

2 miles, 4:16 2-5—W. L. Hibbard, Guttenburg, September 18, 1900.

3 miles, 6:20—J. W. Howard, Newport, August 19, 1900.

5 miles, 9:40 3-5—G. C. Cannon, Providence, October 7, 1901.

10 miles, 20:49—S. T. Davis, Trenton, September 24, 1900.

Electric Vehicles.

1 mile, 1:46—A. L. Riker, Guttenburg, August 18, 1900.

5 miles, 10:44—A. L. Riker, Newport, September 6, 1900.

ROAD RECORDS.

Gasoline Vehicles.

25 miles, 1:06:42—Alexander Fisher, Long Island, April 14, 1900.

40 miles, 1:33:32—E. B. Shaw, Chicago-Joliet, October 18, 1901.

50 miles, 2:30:01—Alexander Fisher, Long Island, April 14, 1900.

700 miles, 3 days 20 min.—A. T. Winton, Cleveland to New York, November 1 to 4, 1900. Actual running time, 38½ hours.

Steam Vehicles.

25 miles, 58:13—S. T. Davis, Jr., Long Island, April 14, 1900; 50 miles, 2:18:27.

Electric Vehicles.

25 miles, 1:00:36—A. L. Riker, Long Island, April 14, 1900; 50 miles, 2:03:30.

MOTOCYCLE TRACK RECORDS.

Motor Bicycle.

1 mile, 1:12 2-5—A. Champion, Vailsburg, N. J., October 27, 1901; 2 miles, 2:31 1-5; 3 miles, 3:47 2-5; 4 miles, 5:05 1-5; 5 miles, 6:22 1-5; 10 miles, 12:47 1-5.

Motor Tandem.

1 mile, 1:18 1-5—Henshaw and Hedstrom, Buffalo, August 13, 1901; 2 miles, 2:36 4-5; 3 miles, 3:58 1-5.

4 miles, 5:20 3-5—Crookes-Scherer, Philadelphia, September 1, 1900.

5 miles, 6:44—Henshaw and Hedstrom, Buffalo, August 13, 1901; 6 miles, 8:04 4-5; 7 miles, 9:25; 8 miles, 10:45; 9 miles, 12:05; 10 miles, 13:22.

11 miles, 16:23 2-5—Miller-Judge, Cleveland, May 30, 1900; 12 miles, 17:56; 13 miles, 19:27 2-25; 14 miles, 20:27; 15 miles, 22:22 2-5.

16 miles, 24:59 3-5—Miller-Judge, Baltimore, Md., September 7, 1899; 17 miles, 26:35 2-5; 18 miles, 27:08 2-5; 19 miles, 29:40; 20 miles, 31:10 3-5.

21 miles, 33:25 1-5—Miller-Judge, Manhattan Beach, N. Y., September 4, 1899; 22 miles, 34:56 2-5; 23 miles, 36:36.

24 miles, 38:11 2-5—Miller-Judge, Baltimore, Md., September 22, 1899; 25 miles, 39:46 1-5.

Motor Tricycle.

1 mile, 1:18 3-5—A. Champion, Chicago, September 25, 1900; 5 miles, 6:49 1-5.

10 miles, 13:37½—Kenneth Skinner, Providence, R. I., October 18, 1901.

44⅝ miles, 1 hour—Kenneth Skinner, Providence, R. I., September 4, 1901; 50 miles, 1:07:10½.

ONE MILE STRAIGHTAWAY WORLD'S RECORD.

Special road record made on the Ocean Boulevard, Brooklyn, New York city, November 16, 1901.

Gasoline.

Henri Fournier 0:51 4-5

Electric.

A. L. Riker..... 1:03

Steam.

S. T. Davis, Jr..... 1:15

H. W.

New Poems by Sappho.

Dr. Schubert, of the Egyptian Section of the Royal Museum, Berlin, claims to have discovered in the papyri recently added to the collection of the museum several entirely unknown poems from the Fifth Book of Sappho. According to the German authority from which our information is obtained the manuscript dates from the sixth or seventh century, and is not in very good condition. The discoverer has been able to decipher two of the poems, one of which describes the poetess of Mytilene comforting a departing pupil. Another is addressed to a former pupil who had removed to Lydia. The poems are said to show new metrical combinations.

SOMETHING ABOUT PELICANS.

BY M. C. FREDERICK.

A few years ago pelicans were quite common along the ocean front at Santa Barbara, Cal. Habitues of the beach took great pleasure in watching their slow, measured flight as they carefully scanned the water fifteen to twenty-five feet beneath, for now and then there was a sudden folding of a pair of wings, a downward plunge with the speed of an arrow, head first, into the sea, the unerring marksman reappearing in a moment and floating on the waves long enough to reveal a glimpse of a fish gliding down his capacious gullet, and to shake the water from his disheveled plumage.

These interesting birds did not remain long after they became the target for so-called sportsmen, and for some reason have never returned to any extent.

The pelican seems to be a very good-dispositioned creature—large and awkward and amiable, like a young mastiff or baby elephant; yet the following incident, so opposite to pelican nature, shows that he, too, is capable of manifesting decidedly opposite traits.

At Goleta, near Santa Barbara, the terror-stricken cries of a nineteen-months' old child brought the frightened women of the family to the rescue. A huge pelican had attacked the little one, who had been playing in the chicken yard, and, with wings extended, was in angry pursuit, making vicious thrusts at the child's head. The great bird made no effort to escape, but pugnaciously stood its ground, even when the women returned after taking the baby to a place of safety, and fought until they succeeded in capturing it. It measured eight feet from tip to tip. No explanation is offered for its strange misconduct, as it was not hurt in any way and there was no apparent reason for its unheard-of escapade.

A white pelican has for years been the pet of a fisherman's family at Santa Barbara. So remarkable is he for his intelligence that tourists go to see and photograph "Larco's pelican" as one of the sights of the city. This one was captured inland, white pelicans preferring fresh water to salt. The eyes are surrounded by lemon-yellow and the pouch is orange colored. Ordinarily the pouch is so contracted that there is little that is noticeable about it until the mouth is opened; and then only when he wishes to expand it for some purpose. The flexible frame suggests rattan, and the two sides remain parallel or bow out at the will of the owner, who adjusts it to any width occasion may require. The pouch itself, soft as undressed kid, is thin and elastic and capable of great distention.

Occasionally he makes a sound like the suppressed grunting of a pig. When he wishes to pick up a stick or other object the side of the head is turned down to the ground, so the object is grasped lengthwise instead of in the ordinary way.

When he yawns—he is as fond of an after-dinner nap as any gourmand—the neck rests along the back and the bill upon it, like a collapsed letter S. The upper mandible rises high in air, there is a flash of yellow as the pouch widens and rises like a big bubble, it vanishes as quickly and all is over. This remarkable appearance is caused by the pouch turning backward (or wrong side out) over the neck and breast.

Jim is a sociable fellow, and fondles friends and strangers alike, when the latter will permit it, by taking their arm, hand or leg repeatedly between his mandibles. His grip is not strong, but there is a strong, sharp hook on the end of the beak that inspires caution.

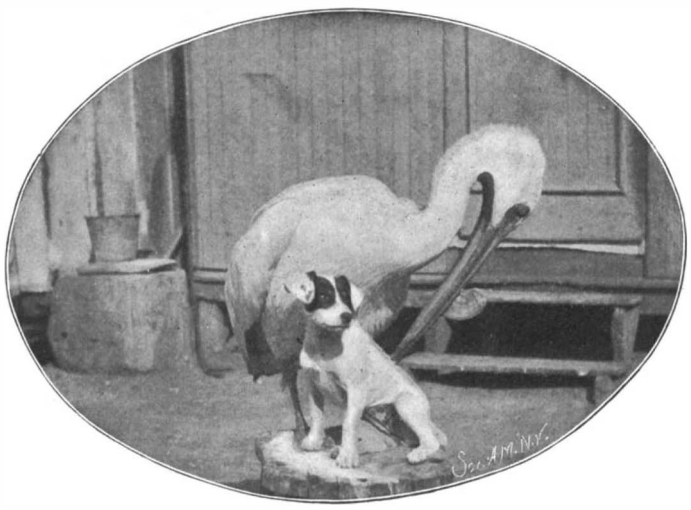
He manifests surprising aptitude in learning the little tricks taught him, and is generally willing to show off for company. At the call of his name he responds as readily as a dog, and is as ready to join in a frolic, catching a ball with great dexterity. This is accomplished by extending the pouch to just the required width, so the ball is as easily held as if caught in a shallow bag.

A favorite trick is to stand motionless while the ball or a pebble is being balanced on his "nose," and then with a quick toss catch it in his mouth.

The human traits of desire for approbation, and jealousy, are displayed to a ludicrous degree, his friend and companion, the fox terrier, usually being the cause of these manifestations. Not infrequently he administers a physical rebuke. In these encounters the pelican generally comes off victorious, the dog prudently retreating before the stabs of the long, sharp-hook-tipped bill.

Otherwise the two live on the most amicable terms. The illustration shows them mounted on an old chair, the pelican scratching the dog's back—their favorite pastime. The satisfaction of the latter is evident from the expression of his face and from the way he leans over toward the bird, one foot resting affectionately on the pelican's foot.

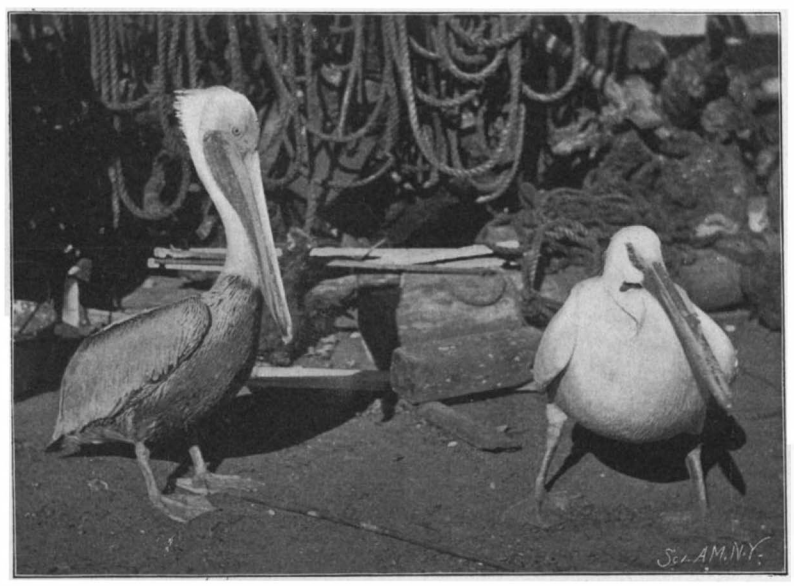
Repeated efforts have been made by the Larcos to domesticate the brown pelican, but while they become very tame they are as stupid as the white one is sagacious, and can be taught nothing; and after a time they fly away with the wild pelicans and are seen no more—except the last one. For several years this one has left in the spring and returned in the fall,



PELICAN AND DOG.

with occasional absences in the winter. His returns are so often followed by a change of weather that he has come to be known as "Larco's weather prophet," and the local papers duly announce his appearance as presaging a storm. This is accounted for by the assumption that fishing is poor during stormy weather, and the pelican knows there is plenty of fish at Larco's to be had for the asking.

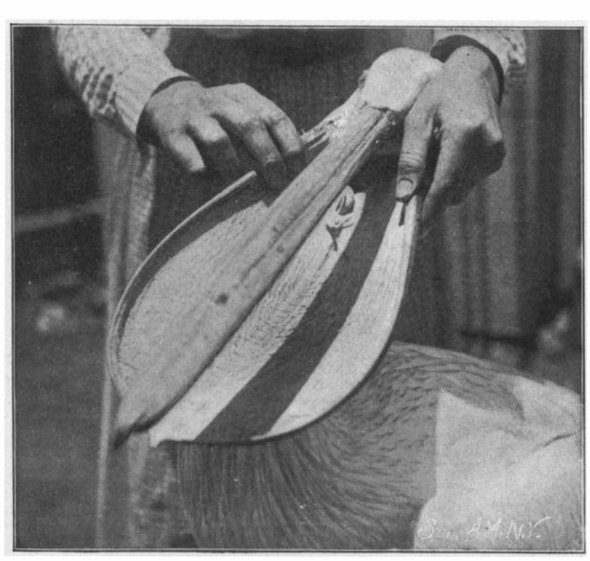
The last departure lasted seven months, and it was thought he had left permanently; but a few days ago he alighted in the fisherman's yard, and was as much at home as ever, accepting the familiarities of strangers as though he had been constantly associated with human beings.



WHITE AND BROWN PELICANS.

The white pelican has never regarded the brown one with favor, though the latter is as friendly as the former will allow. The photograph of the two was taken just after the wanderer's return, and is quite a character study in its way.

The brown pelican is smaller and less graceful than the white (notwithstanding the contradictory evidence of the photograph). The color is brownish gray, or grayish brown, and is called either color. The neck is white, head yellowish, pouch yellowish green with dull red at the throat, and the upper mandible with its large yellow hook has the appearance of having had a coat of bright red paint that has now become sadly weather-beaten. He makes a peculiar hissing sound and snaps his mandibles like castanets.



PELICAN'S POUCH EXPANDED.

The Technical Chemistry School of Berlin.

Technical education in Germany, as is well known, has been developed to a standard of excellence, far superior to that of any other of the great powers. The equipment is of the best; the curriculum is most extensive in range; the professors are the best procurable in the various subjects; and every inducement is offered to the pupils to become thoroughly intimate with certain phases of industry. Probably the Berlin Technical High School is the leading institution of this character in Germany, but it is only typical of similar institutions distributed over the German Empire.

At the Berlin school, in the chemical section alone there are six fully qualified professors for the following branches of this science: Organic chemistry, inorganic chemistry, chemical technology, metallurgy, electro-chemistry, and photo-chemistry.

Further, there are six lecturers for the following branches: Chemistry of foods, including analytical and bacteriological methods; agricultural-chemical technology (sugar, beer, spirits, etc.); vegetable and animal fats, oils, etc., investigation of mineral oils and naphtha products; designing of chemical works and plants; architectural chemical technology; physical chemistry, thermo-chemistry, etc. The comparatively new chair of photo-chemistry affords instruction in spectral analysis, general photography, photo-chemistry, photographic optics, and the construction of photographic optical instruments.

Finally twelve privat docents take the following branches: Electrolytic metallurgy; chemistry of foods; ceramics and mortar; chemistry of the growth of plants; investigation of oils, fats and naphtha, technology of the proteines and albuminoids; repetition of organic chemistry; special chemistry of cement, lime, mortar, plaster, etc.; qualitative and quantitative analysis; aniline dyes; terpenes and camphors; and modern synthetic drugs.

The annual salaries of the qualified professors average $1,725. Various additions to the salaries may be granted by the Educational Council for special services and requirements; up to the present date $2,250 is the highest salary ever paid to any professor of chemistry. They receive further one-fourth of the fees paid by students for lectures in chemistry, and $2.50 per term for every student occupied during the whole day in the chemical laboratories. These additions, however, must not exceed $750 per annum for professors, docents, and privat docents. The professors, lecturers, and assistants are permitted—in so far as it does not interfere with their regular duties—to add to their incomes by private practical work and expert opinions.

The salaries of the assistants average $400 per annum; those who have acted in this capacity for some time may rise to $600. All teachers being state officials, are entitled to pensions.

In 1899 there were no fewer than 41 professors, lecturers, private lecturers and assistants to 278 students, or about one instructor to seven instructed. The average annual expenditure for new apparatus, instruments, repairs, etc., amounts to $8,625.

The Current Supplement.

The front page article of the current SUPPLEMENT, No. 1371, is a handsomely illustrated description of the Charleston Exposition. Of technical interest is a paper on the Paris Automobile Show, illustrated with clear engravings. A succinct discussion of acetylene generators will probably be welcomed at a time when acetylene is gradually widening its field. E. Price-Edwards presents the first installment of an essay on sound signals, which is of particular value in its relation to foghorns. M. Flammarion describes the Perseides as only he can describe them. The discussion of the introduction of a universal language, begun some time ago in the SCIENTIFIC AMERICAN, is continued. The letters received show unusual appreciation of the possibilities as well as the difficulties of the use of such a language.

An official statement recently published regarding the American locomotives purchased by the Bavarian state railroads declares that so far from being unsatisfactory, as various Continental papers have stated, the American engines have proven themselves in many respects distinctly superior to those manufactured in Germany.

THE FUTURE OF PHOTOGRAPHY: AN EARLY PROPHECY BY ARAGO.

At the present time almost everyone makes photographs. Photography is a universal pastime, but it is also a scientific process of marvelous power, and it can be said without exaggeration that it has transformed many of the sciences heretofore dependent upon observation, and introduced into them an almost automatic precision otherwise impossible. This French discovery, the artistic applications of which were at first the most prominent, now appears in its true light as one of the important achievements of the last century, which has seen so many. This seems all the more true as one considers the great field opened to it by the Roentgen rays, etc., and the extensive part that it still plays among things unexplained and unknown. Scientifically the multitude of problems which it asks without answering offers to the physicists of the future one of the most interesting domains to be explored—one of those where they will make, without doubt, the most curious and decisive observations on the inmost essence of matter and of force; practically, we lack only photography in colors, in the development of which we are, at present, at the period corresponding to that of the daguerreotype in monochrome photography. Under these conditions there is considerable interest attached to the predictions made concerning photography at its beginning, some sixty years ago, by one of the most brilliant scientific spirits of the past century—the great Arago.

The report of 1839, an abstract of which we are about to give, is entitled "Report made to the Chamber of Deputies on the Daguerreotype, a process invented by M. Daguerre for producing the images of nature obtained in the camera obscura." This scientific report was addressed to the Chamber, so that it would pass a law according a national recompense to Daguerre. In this report, where Daguerre's process was for the first time made public, Arago recalls at first the camera obscura, the invention of the Neapolitan Giovanni Porta, and the desire aroused immediately in all those who had observed the reproduction of objects in this camera to see a means discovered of perpetuating it. "In the eyes of all," adds he, "this was a dream destined for a place among the extravagant conceptions of a Wilkins or a Cyrano de Bergerac. The dream, nevertheless, has just been realized."

Taking up then the history of the subject, he recounts the first results obtained by Niepce in 1827, results that seemed adapted only "to the photographic copying of engravings." Niepce, who, as we know, allowed light to act on the bitumen of Judea, was obliged to make sun-exposures ten or twelve hours. This rendered impossible the reproduction of even inanimate objects, as the shadows, in this interval of time, would pass from one side to the other. The daguerreotype, the principle of which it is useless to recall, but the two principal instruments of which we reproduce from the drawings of Arago, had just realized an enormous progress.

The apparatus consisted of the sensitizing and developing boxes shown in Figs. 1 and 2 respectively. The silvered copper plate was placed face downward on the supports, *h h*, Fig. 1, and sensitized by fumes from pieces of iodine placed in the cup, *e*, which formed a coating of iodide of silver on it. The exposure was then made and the plate developed by placing it in another box, Fig. 2, where it was exposed to the fumes of mercury at a temperature of 120 deg. to 130 deg. F. The mercury was placed in the bottom of the box, *P*, and heated by the alcohol lamp, *U*. The development was watched through the window, *S*. The plate was afterward fixed in a hyposulphite of soda solution.

"The rapidity of the method," says Arago, "is perhaps what will most astonish the public. In fact, scarcely ten or twelve minutes are needed in the dark days of winter to complete an exposure of a monument or a street scene. In summer, with bright sunlight, this time can be reduced one-half." What would he have said at the one one-hundredth of a second exposures of to-day? But the remark that follows is of still greater interest at the present moment: "The making of a daguerreotype does not include a single operation that cannot be learned by anybody. It does not require any knowledge of drawing or any manual dexterity. By conforming point by point to certain very simple directions there is no one who cannot succeed as certainly as M. Daguerre himself."

In the following note is also to be found a scientific truth that is truly remarkable: "People will perhaps have made thousands of beautiful daguerreotypes before its mode of action will have been completely analyzed." Not thousands, but millions of photographs have already been made, and the essential principle of the process has not yet been determined, viz., the modification undergone by the iodide, the chloride, or the bromide of silver under the action of light—a modification that only becomes visible under the action of the developer.

Arago thought immediately of the reproduction of monuments in foreign lands, of exact copies that the Egyptian expedition could make of hieroglyphics afterward destroyed. He indicates, along with Paul Delaroche, the advantage that painters will have from photography (an advantage which of all the primitive hopes is the one the least realized, since it has brought us only those make-believe photo-chromos against which the true artists have reacted by impressionism);

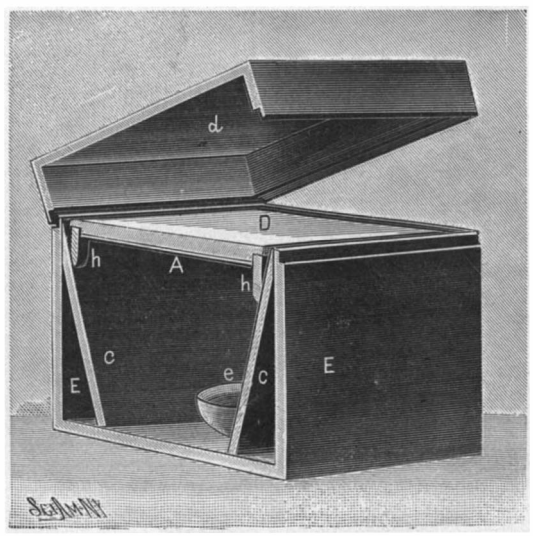


Fig. 1.—SENSITIZING THE DAGUERREOTYPE PLATE.

he asks but two principal questions (which make us smile to-day)—whether photographic methods will become common, and whether they can be applied to portraiture.

Replying to the first he remarks that the plate used by Daguerre is a trifle cumbersome, and that it might be preferable to have sensitive paper, as Daguerre had thought of at first. In connection with this, we know what have been the successive steps surmounted in obtaining a proper support for the sensitive surface; plates of copper coated with silver, waxed paper, glass, and, finally, celluloid film. The numerous defects of this last substance as it is manufactured to-day, the constant failures that it occasions by its rapid decomposition, by the difficulty of handling it, etc. and the fatigue that it causes when developing it, make it much to be hoped that some one will soon discover the photographic paper dreamed of at first by Daguerre.

The price of daguerreotype plates is equally curious to recall; it ranged from 60 to 80 cents per plate. Here, too, is another amusing passage: "They delude themselves—those who, but recently, when about to set out on a journey, declare they wish to make use of the different times when the stage is ascending hills to take pictures of the surrounding country. A person is no less deceived when, struck by the curious results obtained in reproducing pages and engravings from very old works, he dreams of the reproduction and multiplication of photographs by lithographic methods." What would Arago have thought if he could have been transported into Switzerland in 1901, in the midst of the army of hand cameras, which operate

Fig. 2.—DEVELOPING A DAGUERREOTYPE WITH MERCURY FUMES.

even on trains in motion (it is true that the movement of Swiss trains is majestic), in the midst of misses and fräuleins who send home souvenirs on postal cards illustrated by photographs? The following reflection, however, counteracts the disappointment that this future causes him: "But it should be remembered that when observers apply a new instrument to the study of nature, what they hope to obtain is relatively small, compared to the succession of discoveries of which it becomes the origin. For this reason it is on the unforeseen that one must especially count."

As for portrait photography, this is what Arago said of it: "In general, we are scarcely disposed to admit that one will ever be able to use the same instrument to make portraits. The problem contains, in fact, two problems apparently irreconcilable. In order that the image may be obtained quickly, that is, within the four or five minutes that the person posing must remain immovable, it is necessary that this person sit in bright sunlight. But such a bright light causes the most impassive person to wink and squint involuntarily." And he then tells how Daguerre in some measure got around this difficulty by interposing a blue screen.

The scientific side of the question naturally appealed to Arago. He mentions immediately the possibility of making photographs of the moon, of studying the rays of the spectrum, etc.; but what he says about photography in colors is particularly interesting, since in that lies for us the problem of the future.

"The question has been asked," he says, "whether we will ever be able to reproduce colors by the daguerreotype. . . . This problem will be solved the day some one discovers a substance that the red rays color red, the yellow rays yellow, the blue rays blue, etc. M. Niepce has already described effects of this nature where, in my opinion, the phenomenon of light interference in thin films plays a certain rôle [this is the principle of the great discovery of M. Lippman]. Perhaps he has accomplished the same with red and violet as Seebeck obtained simultaneously on chloride of silver, at two ends of the spectrum. M. Quetelet has just sent me a letter in which Sir John Herschel announces that his sensitive paper, after having been exposed to a very brilliant spectrum, showed all the prismatic colors with the exception of red. In the face of these facts it would be hazardous to affirm that the natural colors of objects will never be reproduced in the photographic image."

We have with us to-day, sixty years after, the same problem. We can produce, by a prolonged exposure, veritable colored and fixed daguerreotypes, but the color can be seen only by holding them at a certain angle and the plates are not susceptible to the obtaining of multiple prints. This is about the point to which photography had advanced in 1839. Perhaps the next half century will give us real photography in colors; that is, the direct and complete fixing of the colored image as it is seen on the ground glass of the camera.—La Nature.

Hydraulic Plant at Vizzola, Italy.

The hydraulic plant of Vizzola, which already distributes more than 15,000 horse power for lighting, traction and electrolytic industries is the most important installation which has been made in Italy up to the present time. The abundant waters of the Tessin, from the point where it leaves the Lago Maggiore to its confluence with the Po, were long used for irrigation, but until recently no attempt had been made to utilize their fall, which is considerable, for the production of light and power. A project had been set on foot as early as 1889 in connection with the Villoresi irrigation canal which provided for utilizing about 40,000 horse power, and in 1896 the Italian company obtained an authorization from the government which would allow of the development of this project and give them a fall of 75 to 90 feet. In the winter of 1898 the work upon the hydraulic installation was begun by the Lombard company and their great undertaking was brought to a successful end after more than a year's work. The mechanical and electrical parts of the plant have also been well carried out. The machinery building, which is erected near Vizzola, contains a plant which will produce 23,000 horse power when working at full load. There are 10 generating groups, all alike, each being made up of a horizontal turbine directly connected to a dynamo; each group has a capacity of 2,200 horse power. There are also a number of smaller turbine groups for use as exciters, etc. The large turbines have been built by an Italian firm, Riva, Monneret & Co., of Milan, and the electric outfit has been installed by the Schuckert company. The triphase current leaves the station at a tension of 11,000 volts, and is carried by 24 main feeders to the distribution circuits for lighting and power, which have a total developed length of 90 miles. These circuits supply all the neighboring region. The present distribution of energy from the Vizzola plant has reached 15,000 horse power, and is continually on the increase. It is estimated that by using hydraulic power this plant makes a yearly saving of $500,000.

A Moth's Knife.

The Entomologist describes a peculiar instrument by means of which the silk-producing moths of the Australian genus Antheræa cut their way out of their hard cocoons. The instrument "is a short, hard, black, and curved thorn, situated in the thick joints at the base of the forewings, one on each side. In a rubbed specimen the thorn is easily discernible; but in a good one it is concealed among the dense scales."

RECENTLY PATENTED INVENTIONS.

Electrical Apparatus.

ELECTRIC LAMP.—W. MCCONNELL, Brooklyn, N. Y. The lamp or torch is of the class designed to be carried in the hand or pocket, and the invention lies in a circuit-closer, by means of which an intermittent or flash light may be produced, or the circuit held closed for any desired length of time. The lamp comprises a body portion containing an electric cell and a lamp in connection with one pole of the cell. A spring-plate on the body has electrical connection with the other pole of the cell and is adapted to be engaged by a keeper-plate having connection with the lamp.

Mechanical Devices.

MACHINE FOR MAKING PIPE.—J. H. MARTIN and D. ORMAND, Riverside, Cal. Two patents have been granted to these inventors for a machine of this kind. The inventions relate to apparatus for making pipe of plastic material, such as asphalt. In the first invention, the asphalt is fed into an annular revoluble mold. Stamps working therein pack the material down, and trailers attached to the stamps keep them at the proper elevation with respect to the upper end of the pipe section.

The second machine is designed for making continuous lengths of pipe, such piping being adapted particularly for use in conduits or trenches carrying electrical wire. The plastic material is placed in a hopper and automatically pushed down into the throat of the machine. Upon starting the motor, the plastic material is pushed out from the throat around a core and within the rear part of the casing. This forms a continuous piping, and as the piping sets or hardens, the action of a plunger causes the entire machine to be pushed forward.

COAL-WASHER AND ORE-CONCENTRATOR.—A. C. CAMPBELL, Asheville, N. C. A reciprocating motion and a percussive action is given to the pan to cause the separation of more dense stuff and the less dense stuff into two principal layers. The top layer is floated away by the escaping water and is discharged over the tail end of the pan into a sluice, while the lower layer or more dense stuff is discharged at the head of the pan.

MACHINE FOR MAKING COMPOUND PAPER.—C. P. BROWN, Comstocks Bridge, Conn. The machine is designed for pasting together two webs of paper during the process of manufacture, and comprises a plurality of press rolls arranged in the form of a hollow square in which is located a paste roll for applying paste to one of the webs before they are pressed together.

PROPELLER GEAR.—G. W. GARDINER, Philadelphia, Pa. The propeller gear comprises a frame arranged in a trunk formed in the vessel and adapted to be lowered below the bottom of the vessel. The invention is applicable to boats of all kinds, and if applied to a centerboard vessel, the trunk carrying the centerboard may be enlarged so as to receive also the propeller gear and one or more centerboards.

ROCKER ATTACHMENT FOR SEWING-MACHINE TREADLES.—F. P. HARRIS, Greenville, Ky. The physical exertion required for operating the ordinary sewing-machine treadle is greatly reduced by using the rocker attachment here described. A foot rocker is mounted on the treadle, being held thereto by springs which tend to keep it balanced. When pressure is brought to bear on the toe or heel of the rocker, the power must be conveyed to the treadle through these springs, thus giving an elastic motion free from any sudden strain.

RAKING DEVICE FOR FURNACE GRATES.—J. C. MCDONALD and M. BRENNAN, Sidney, N. Y. The device comprises a raking frame normally located under the grate and provided with spaced bars adapted to pass between the grate bars. A crank shaft is connected to one end of the rocking frame, which gives the frame an up-and-down swinging and lengthwise-traveling motion between the grate bars.

Vehicles and Their Accessories.

WHEEL.—A. A. VÉREL, Glasgow, Scotland. The distinguishing feature of this wheel is found in an outer rim held to the hub by spokes passing through slots in an inner rim. Tension and compression springs are applied to the inner ends of the spokes, and interpose between them and the hub.

TRUCK.—E. S. PERKINS, Auburn, Logan county, Ky. The truck comprises a bed or platform provided with an opening, into and out of which a platform section is vertically movable. This section may be raised to receive or deliver goods at different heights, this being desirable when the truck is used for baggage or freight in connection with railroads or in commercial houses.

WAGON GEAR.—J. AUSTIN, Pitkin, Colo. The invention relates to mechanism for facilitating the starting movement of wagons or other vehicles. It consists in a gear connected directly with the team and arranged to act directly on the wheels so as to impart turning movement thereto, after which the gear is automatically thrown out of action, and the vehicle is drawn in the usual manner.

MEANS FOR SECURING ELASTIC TIRES TO WHEELS.—W. F. WILLIAMS, London, England. Improved means are employed for securing elastic tires to the rim of a wheel by bands. The invention consists essentially of a combined tension screw and worm gear, the latter acting as a nut to apply the requisite tension to the screw. The tension screw is curved approximately to the curvature of the wheel rim, and is provided with a hook or other means of making detachable engagement with one end of the holding-on band, the other end of which is fixed.

WHEEL FOR VEHICLES.—H. EDENBOROUGH, Snaresbrook, England. The invention relates to wooden wheels of field guns, wagons or other vehicles, and provides for readily tightening up the wheel when the fellies and spokes become loose. The wheel has its rim coned in opposite directions on the external circumference. An outer encircling tire-band forms the tread of the wheel, and two opposed series of segmental wedges are located between the rim and the tire-band, these wedges being oppositely coned on their internal circumference to correspond with the circumference of the wheel rim. Transverse bolts are adapted to draw the outwardly coned segments toward each other with a wedge-like action, so as to take up all slack.

VEHICLE ATTACHMENT.—W. P. LEE, Fairfax, Minn. The purpose of the invention is to provide an attachment for single-horse vehicles which will enable the wheels to run in the beaten track, while the horse may travel at one side of the center of the road in one of the tracks made by a double team of horses. The thills are attached to the front axle at one side of the center. In order to compensate for the non-uniform draft which this arrangements transmits to the axle, a compensating spring is provided.

Miscellaneous Inventions.

STAMP PAD.—E. G. WOODY, New York, N. Y. With the usual form of stamping pad constructed of felt, at certain times, especially in warm weather, an unnecessary quantity of ink rises to the surface, resulting in a blurred and imperfect impression. In this pad a practically uniform surface thickness is at all times maintained. The stamp pad consists of open grained wood impregnated with ink and having a rough surface which serves to insure an even distribution of the ink.

BED SPRING.—F. MOEHLE, Sheffield, Iowa. The object of the invention is to provide a bed-spring that may be readily adjusted to bedsteads of different sizes and may be quickly taken apart and packed in a small space. The frame of the bed-spring comprises side rails of tubular metal threaded at their ends into corner castings. The head and foot rails consist of pairs of bars. Rollers or tubes are mounted on these bars. If it be desired to widen the frame, it is merely necessary to add short tube-sections. The springs consist of metal plates which pass over the rollers at the head and foot of the frame, and whose ends underneath are connected one with another by helical springs.

WASH BOILER ATTACHMENTS.—MARY C. SONNEBORN, Laporte, Ind. The device is designed for lifting clothes from a wash boiler, and is so arranged that upon lifting the device it will operate to squeeze a portion of the water out of the clothes, after which it may be suspended from an attachment on the boiler to permit draining.

CARPET STRETCHER.—J. WHIKEHART, Zanesville, Ohio. The stretcher has a longitudinal member provided at one end with a metallic claw. Pivoted to the other end is a lever which rests at one end on the floor and has pivoted to its other end the stretching lever. This lever has a handle and terminates at its lower end in a cross bar provided with teeth. By pressing down on the handle these teeth are caused to force the carpet toward the anchor claw. A ratchet bar holds all the parts in the position they assume when the handle is depressed.

FENCE JACK.—L. C. KELLY and C. E. AMSPACHER, Charlotte, Mich. The leading object of the invention is to provide improved details for a fence jack which will keep the carrying wires of the fence taut and compensate for the general shortening of these wires when twisted to retain upright pickets in spaced position thereon.

GRADER.—J. BAGLEY, Tacoma, Wash. The apparatus is adapted for scraping and hauling earth in grading, and is also applicable in ditching and dredging. It has vertical side plates rigidly connected together. A rear end plate extends between the side plates and is curved around a horizontal axis presenting the concave side to the front of the grader to form a bucket. Blades are fastened along each edge of the bucket.

ARTIFICIAL DENTURE.—A. F. COGSWELL, Crete, Neb. The invention relates to artificial crowns for natural roots of teeth and provides metallic backing for the wearing surface of the tooth, also, in connection with this backing, an anchor post or stud. This stud extends through the crown tooth and is anchored in the canal in the root to which the crown is applied. The metallic backing and the stud are separable from the crown so that the latter can be conveniently ground to accurately fit upon the outer end of the root.

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Factory room with power, steam, elevator, etc.; good light, also storage room. Chas. F. Kilburn, 84, 86, 88 Mechanic Street, Newark, N. J.

Inquiry No. 2386.—For manufacturers of springs for bodies of automobiles and vehicles.

WANTED.—Partner to finance several inventions. Foreign and domestic patents to secure. Address Inventor, Box 81, Cygnet, Ohio.

Inquiry No. 2387.—For dealers in granite-steel and tin cooking utensils.

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Inquiry No. 2388.—For dealers in uncured sheet rubber of different thicknesses and degrees of softness.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 2389.—For manufacturers of mortar-mixing machines.

Patents developed and manufactured, dies, special tools, metal stamping and screw machine work. Metal Novelty Works Co., 43-47 S. Canal St., Chicago.

Inquiry No. 2390.—For a portable machine for extracting hemp fiber from the hemp plant.

ELECTRIC DRY BATTERY.—Manufacturers submit free samples with casting qualities. Quote prices for quantities. Darling Motor Company, Chicora, Pa.

Inquiry No. 2391.—For machinery for making sticky fly paper.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 2392.—For manufacturers of double-braid asbestos wire.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

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April 1, 1902,

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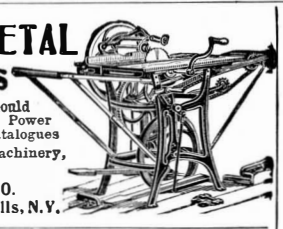

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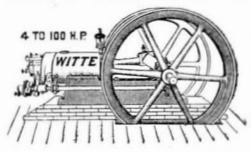

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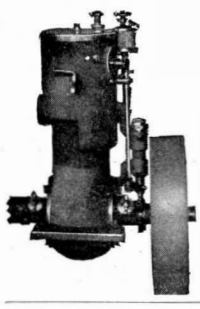

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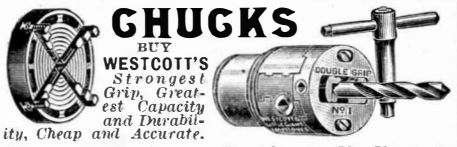

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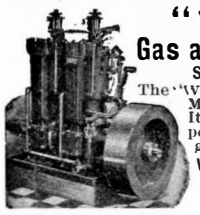

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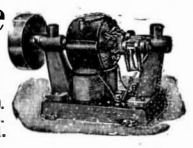

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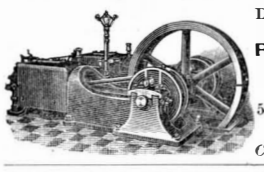

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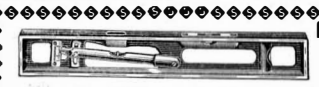

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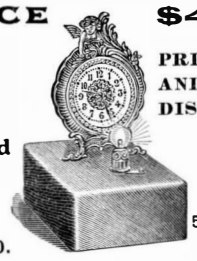

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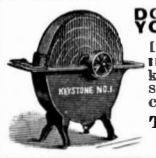

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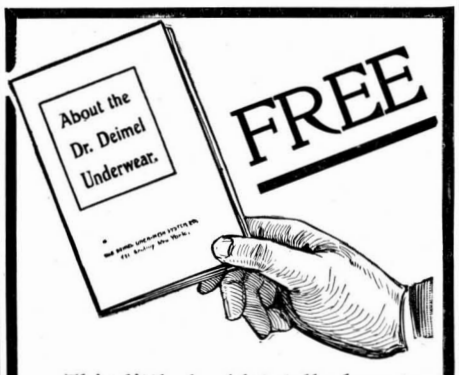

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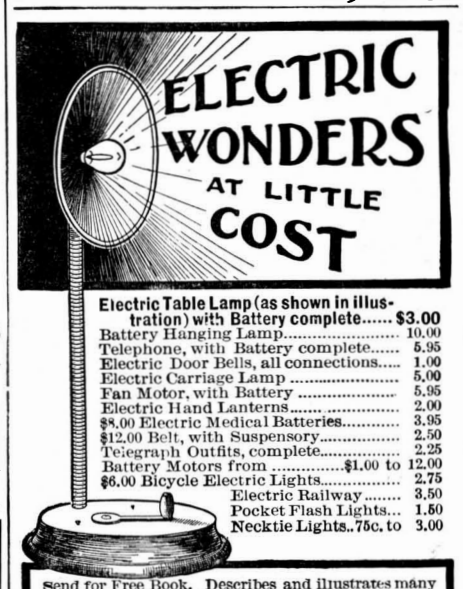

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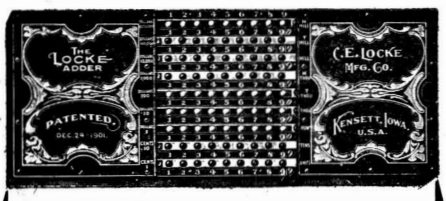

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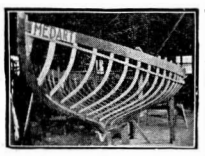

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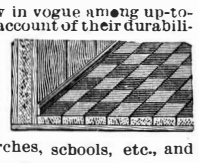

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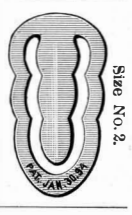

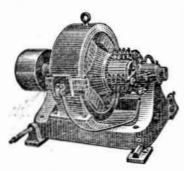

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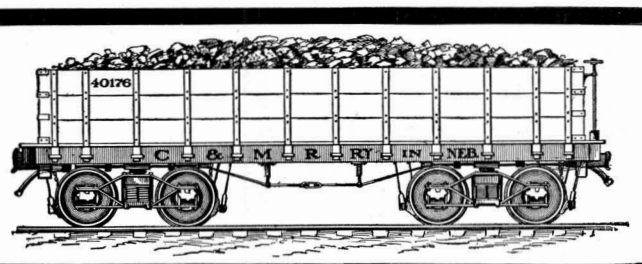

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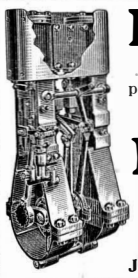

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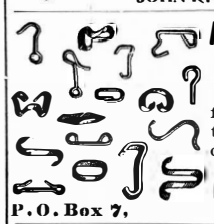

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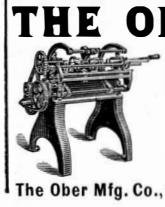

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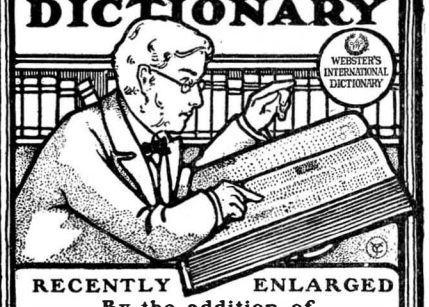

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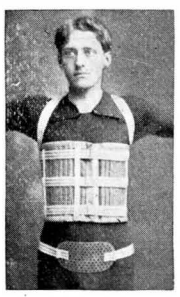

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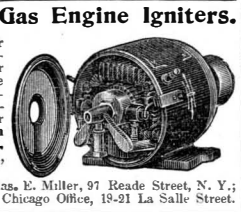

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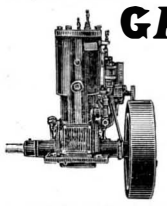

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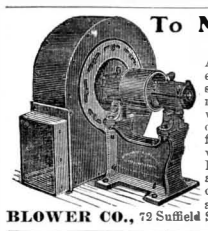

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(Continued on page 267)

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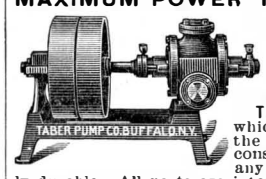

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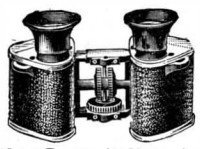

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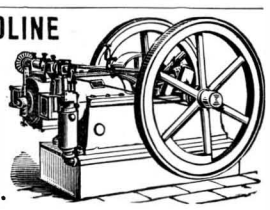

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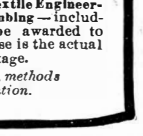

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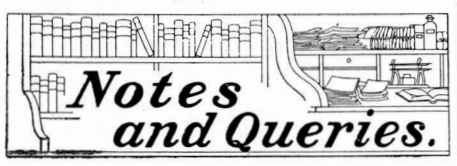

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(8581) A. C. asks for a recipe to take an instantaneous picture similar to a tintype upon surface of a sea shell. What chemicals, etc., are required for the purpose? A. The surface of the shell must be coated with a sizing and then sensitized. You can obtain the materials and chemicals from any dealer in photo materials.

(8582) J. S. B. asks: In your issue for February 22, on page 124, you have an article on hydrate of potassium. You say that it burned in oxygen, forming potassium hydrate and water; then this equation would be true: $KH + 2O = KOH + H_2O$, which cannot be balanced. Can you make this clear? A. If the formula for potassium hydride is KH and it were burned in O, the product would be at first K_2O, potassium oxide. Upon cooling this would combine with water, which would be formed and yield KOH. This is the reaction: $2KH + O_2 = K_2O + H_2O$; and $K_2O + H_2O$ becomes 2KOH. Chemists think that hydrogen does not form definite compounds with the alkaline metals.

(8583) A. B. McK. asks: Will you kindly give me what information you can on the following subject? Take a piece of steel and cut in two pieces. Make one as soft as possible and the other as hard as possible; now, what will be the difference in resistance in ohms, if any? A. Barus and Strouhal give the specific resistance of glass-hard steel as 45.7 and of soft steel at the same temperature as 15.9. This is the resistance in thousandths ohms of a bar one square centimeter in cross section.

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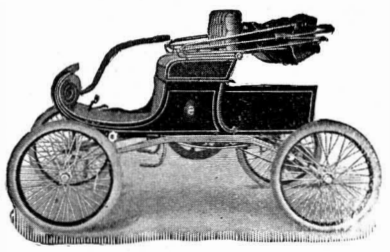

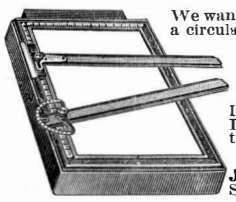

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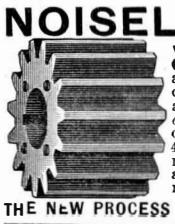

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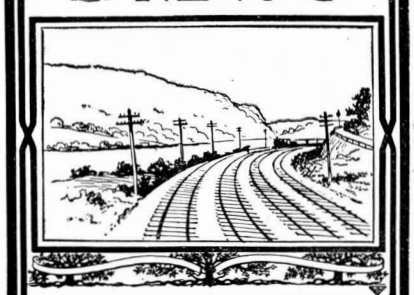

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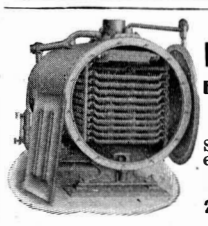

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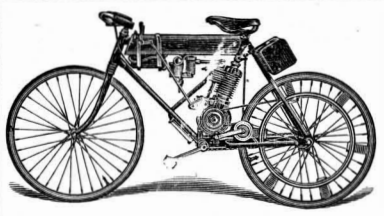

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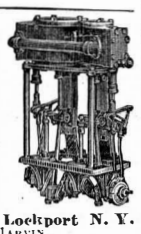

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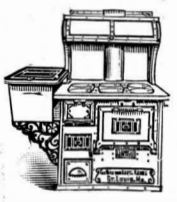

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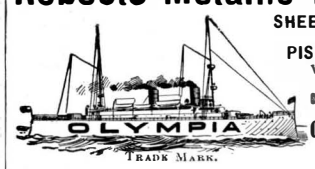

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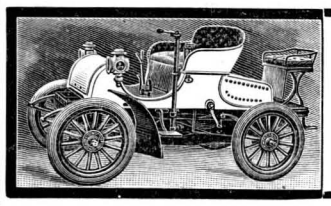

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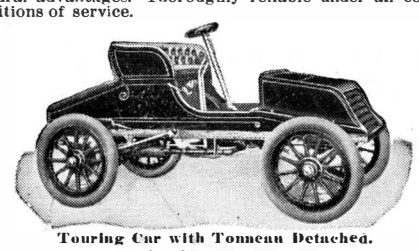

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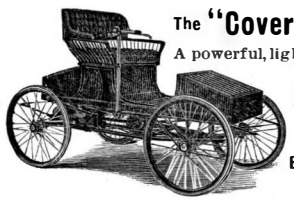

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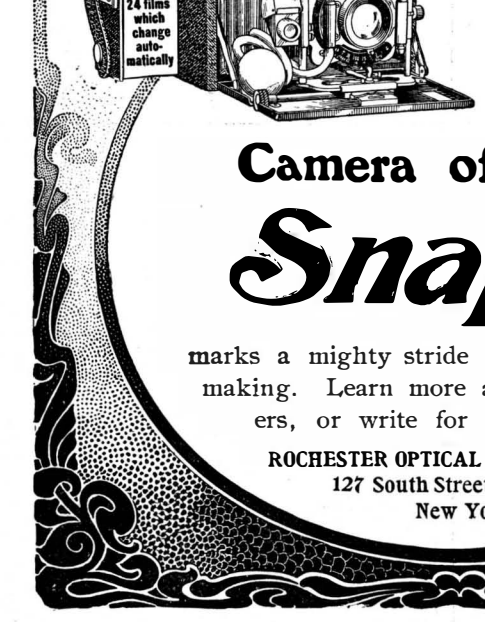

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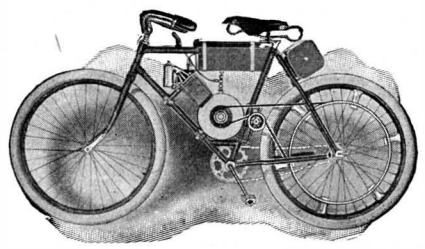

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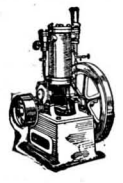

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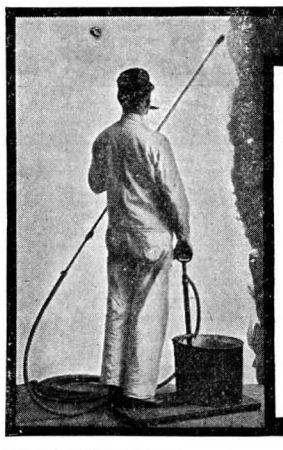

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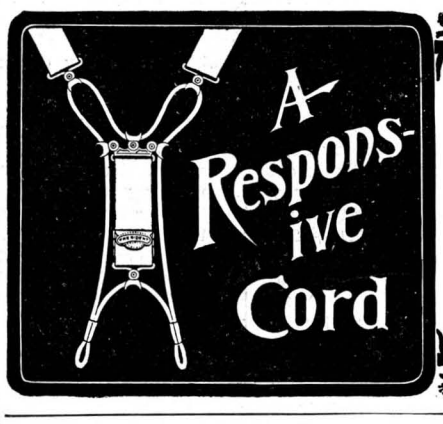

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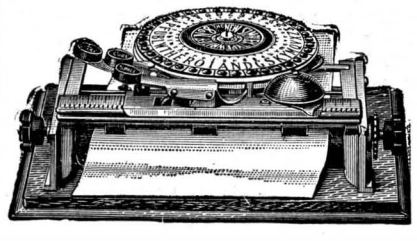

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